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BRIEFLY TOLD.

DEATH OF FRED. W. DAY, OF COLUMBUS, OHIO.—Some days ere this notice shall have aroused the sympathies of our craft, the grave will have infolded in unrelenting embrace all that was mortal of a bright and promising man—Fred. W. Day, late Superintendent of Distribution of the Columbus Gas Light and Coke Company. At the Sandusky session of the Ohio Association were one asked to predict who might next be called upon from out of that gathering to pay the last and supreme draft which nature draws upon her creatures, the subject of this memoir would not have been even thought of in the prediction. However, grim death, in his fatal choice, pays small respect to the probabilities, and, in fact, riots greatest when his seal is placed on youth, abounding seemingly in the vigor which all that term implies. Mr. Day's summons to earth came at midnight, on Friday, 25th ult., the inciting cause being traceable to a rather severe cold, which subsequently developed into acute peritonitis. His illness, from inception to its fatal termination, lasted 8 days. Our readers will take it for granted, more especially those who were personally acquainted with his lively and generous ways, that his superiors and confreres on the staff of the Columbus Company will sadly miss an honest employee and a tried friend. Deceased entered the Company's service in 1877 (then in his 17th year), and, step by step, he advanced to the responsible position from which death alone removed him. A widowed mother, to whose comfort it was his best pleasure to minister, survives him. The funeral services were celebrated last Monday, and the attendance thereat attests the high esteem in which deceased was held by those best fitted to form an opinion on his merit as a friend and his worth as a man.

THE DISASTER AT MONTREAL, CAN.—Advices from Montreal, Canada, dated May 26, bring an imperfect report respecting an accident—which evidently resulted from an utter disregard of the hard-and-fast law about a gas works that prohibits the use of lights in certain divisions of such establishments—that caused a deplorable loss of human life, and the destruction of much valuable property. While not at present in possession of sufficient facts to claim to speak with accuracy, the reports go to show that the huge holder recently constructed by the Montreal Gas Light Company for the better supply of what is locally known as the Hochelaga district of the city, and which was either recently put in action or was being tested, had developed a leak—as a rule all gasholders in the Dominion are inclosed in brick buildings, as was the case with the one in question. The necessary preliminary preparations were at once made to discover the defective points, and when these had progressed sufficiently a workman, *carrying a lantern*, is said to have attempted to enter the tank through the crown manhole. A tremendous explosion instantly took place. The massive roof of the house was hurled upwards, the walls were thrown outwards, and the wreck was complete. The roof settled back on the holder, and it is supposed that this descent is responsible for the greater part of the fatal injuries received by the laborers. Of these 6 were instantly killed, while it is reasonably certain that out of 10 others injured 4 will die. The monetary loss is put at figures varying between $50,000 and $100,000; although it is likely the lesser estimate will about cover the maximum damage. We hope in our next to give some reliable account of this awful disaster.

THE PHILADELPHIA TAR CONTRACT.—Mayor Fitler, judging from the temper exhibited by him over the matter—said ebullition having been manifested something like ten days ago, and it was quite after the style of the Hon. Mr. Hewitt, of New York—is not disposed to give away the tar produced at the local gas works. At least we judge so from the fact that letters were forwarded to the two bidders—Messrs. Stellwagon's Sons and M. Ehret & Co.—informing them that their bids had been rejected, and that it was the intention of the Corporation to once more advertise for proposals, "under modified specifications." In commenting on this matter at the present time, we must confess to make our approach thereto somewhat in line with the party whom we are told once hung suspended between the devil and the deep sea. In the first place, we must either appear to defend the tar-combination—which is in bad odor with independent gas makers just now, by condemning what, at first glance, and despite the stated reservation on the part of the city of the right to reject any and all bids, seems to be tantamount to a virtual breach of good faith; or, on the other hand, to defend the city's action at the expense of those who seemingly bid in good faith. However, since he who hesitates is lost, we will plunge into the sea, consoling ourselves with the reflection that his sulphurous majesty's nominal condition might be improved were he to follow suit. The prices at which either of the would-be contractors—on the 3-years' basis Ehret bid 21⅛ cents, the Stellwagons offering 26¼ cents per ton of coal carbonized—offered to take the tar are ridiculously inadequate. We have no hesitation in asserting, so amazingly has the demand for this residual increased within the last 18 months, that were the tar trust to fail of its cohesive powers, the Philadelphia Corporation would have no trouble in obtaining 2½ cents, or even 3 cents, for every gallon of that ill-smelling article made on its works. So thoroughly in control of the situation, however, does the tar trust seem to be, that those who would like to take an independent hand in the fray scruple not in saying that such action would involve them eventually in financial ruin. The organization, then, amongst the tar men compels our admiration for its thoroughness, although still continuing to deprecate their rapacity. While on this subject it might be well to state that some of our gas makers—notably those on the line or within easy striking distance of the Ohio river—are becoming restive over the grip in which they have been held by the trust; and, if we mistake not, the Secretary of the combination is to be chastened soon by a stroke of asperity in the shape of the non-renewal of his contract with the proprietors of the Louisville, Ky., Gas Light Company, who, we understand, are seriously thinking of working up the tar product of their plant, on home account and risk. Be this as it may, and we hope "it may," we are inclined to think that Mayor Fitler and Director Wagner, in taking advantage of their specified right on behalf of the city to, for its protection, reject any or all bids, have justice on their side in again asking for a better or a more generous allowance from the kings of the Tar Trust. In closing we may say that the highest bidder in the last contest proposes to appeal to the courts for relief; but we fail to see on what ground they hope to secure a verdict, remembering that fatal "right to reject" proviso in the specifications.

LOWELL, MASS., ALMOST AT THE COVETED FIGURE.—He who a decade ago assured his hearers that any Eastern gas company would at the end of that decade be selling gas to *all* its consumers at the net rate of $1 per thousand, would be either flouted as an enthusiast or pitied as a crank. But the passing of the years would have dissipated the verdict of the scoffers; for Boston has sold—although the rate is not an universal one—and is selling gas at the famous dollar mark, and Lowell is all but in the same boat. In fact we think the Mack-Bartlett-Cushing dynasty will be eventually entitled to the credit of having, without any other inciting cause than the laudable one which spurs any set of manufacturers to make fair profits out of big sales, instead of trusting to secure bigger profits out of smaller sales, first fairly gained the dollar goal. In the spring of this year the net price of gas in Lowell was reduced to $1.10 per thousand; and we have every reason to say that by May 10th, 1889, the lonesome dime will have been sent off to find companionship with the other fractional currency that, at one time or another, has been lopped off the face of the Lowell gas consumer's monthly account, "as rendered." In order to show that Lowell's progressive course has not been unduly influenced by conservative capitalization, we mention that, reckoning on capital per thousand cubic feet of gas sold, four other Massachusetts companies are better off in this respect than is the Spindle City Company—namely, the old Boston Company, and the ones at Adams, Haverhill and Taunton—the figures, in respect of each instance, in the order above named, being: $2.923, $2.185, $2.896, $2.082 and $2.818. To show that the Lowell mills do not take nearly all the gas made by the local Gas Company, it may be mentioned there are 6322 meters in use in the city, of which 4,767 are either 2 or 3-light capacity. To further emphasize this feature of the Lowell situation, it may be mentioned that the average consumption (per annum) per consumer is 25,809 cubic feet, which per capita showing is exceeded by no less than 14 other companies in the State. In the number of consumers per mile of main, however, Lowell has quite an advantage, in that these are returned as 96.7; although here again 3 other companies enjoy a better position—the old Boston, with 209.7; Haverhill, 110.4; Worcester, 97.5. The residuals receipts figure prominently in the search for a reason why Lowell can be so generous, for these are seen to be equal to 53.61 per cent. on the cost of coal carbonized. The figures above given are taken from returns for year ending June 30, 1887. Supt. Cushing means business, and always did.

ANNUAL MEETING, PORTLAND, MAINE.—Supt. Yorke came with flying colors out of the contest with electricity in Portland during the last year, if the reports read at the Company's annual meeting (held May 16) are to be accepted as evidence of an impartial nature. We think, though, that President Daveis may be trusted to have told the whole truth to the stockholders, especially since the latter subsequently selected him to be their chief executive for the ensuing year, to which we might add that Treasurer Rolfe and Accountant Griffin were similarly honored. During the year the Company's output amounted to 49,467,000 cu. ft., and the consumer's list was increased to 2,684—a gain of 59. The extraordinary expenses during the year included the cost (about $1,500) of a new roof to the retort house; and we notice that the President pays a well-merited tribute to Supt. Yorke for his vigilance in this instance. We have, along with our readers, known of instances where the weakness of similar structures in other parts of the country, was not discovered until shortly before either the building department or the coroner was summoned to make an inquiry or to hold an inquest. During this season the Company will renew 8 benches of sixes, will put in a new exhauster, and construct a new revivifying shed, besides making considerable main renewals and extensions. Probably $10,000 will be needed for this work; but "the Company has the money in its banker's vaults." As stated some time ago in the JOURNAL, the Company not long since made a 20 cent reduction in selling rates, and while President Daveis admits that this, on the former output, means a nominal decrease in receipts of $10,000, he nevertheless expects that the increase in sendout, because of the concession, will recoup the nominal loss—and we agree with him. The Company is in a most flourishing condition, and the stockholders, with the single exception of the city—meaning Mayor Chapman—are satisfied and happy. Mention of his Honor causes us to revert once more to the scheme for disposing of the city's shares, the bids for which were opened, as per programme, on Monday, May 21. To show whether the city's holding should be considered a doubtful asset, we have merely to point to the following prices that were offered, and to the peculiar character or avocation of some of the bidders—the city's holding being 1700 shares, par value of same being $50: E. P. Oxnard bid 70 for 100 shares, and would give 75 for a second hundred; the Portland Savings Bank bid 90 for 850 shares, and the Maine Savings Bank wanted the balance at the same figure—the security is not good enough for the city, which is receiving 10 per cent. on its investment, but is eagerly snapped at by men sworn to faithfully guard the savings of the poor and rich entrusted to their custody, even though 5½ per cent. was all that the bank investment would net. The bankers, however, were outbid by Messrs. H. M. Payson & Co., who offered 95½ for the entire block. The Mayor, we opine, did not look for such high figures; but, in any event, the latter will be reported back to the City Council, who may yet prevent the change in ownership from taking place.

OPENING AN AGENCY.—Hereafter the Ball Engine Company, of Erie, Pa., will have an office in New York city, which step was decided on only after much cogitation on the part of its managers. Why they did not arrive at a speedier conclusion is matter for wonder, since the Company has placed many of its engines in and around the metropolis. Better late than never, though. Mr. Vincent, of the firm of C. R. Vincent & Co., will act as manager of the New York headquarters, which are located at No. 13 Cortlandt street, room 62.

IN COMMAND AT GAINESVILLE, TEXAS.—Mr. T. C. Hopper, of Philadelphia, Pa., having acquired a large interest in the Gainesville Gas and Coal Company, has placed his son (Edward L. Hopper) in charge as Superintendent. The plant is to be enlarged and improved, notable among the retort house changes agreed upon being the addition of 1 bench of 5's and 1 of 3's. This ought to prove a profitable venture, for Gainesville is growing rapidly. The officers of the Company are: President, J. M. Lindsay; Vice-President, C. C. Hemming; Secretary, H. Lindsay.

Natural Gas Fires and Explosions.

Mr. Webster, a noted authority in American fire insurance circles, contributed the following interesting article to a recent issue of the *Chronicle:*

Two important new conditions, which may have a very considerable influence on fire hazard, have recently forced themselves upon the attention of fire underwriters, viz., conditions brought about by the increasing use of gas as a domestic and manufacturing fuel, and conditions due to the extensive application of electricity. The fuel gas and electric age is now in its infancy, but no man who looks into the future can doubt that it is destined to be a great progressive epoch in the history of the world.

We purpose making a brief and impartial investigation of the fire hazard of gaseous fuel, as illustrated in the use of natural gas in the State of Pennsylvania during the past three years, and shall set down what we believe to be facts as far as we are able to extract them from available statistics.

Within a year or two past we have found many occasions to protest against extravagant claims put forth by natural gas enthusiasts as to the "perfect safety" of this fuel. Our position has been agnostic. We declined to concede, in advance of experience, that a gaseous fuel, whether natural as it now is, or artificial as it sometime may be, is the safest of fuels. Nor do we believe there is as yet sufficient evidence on which to base a final conclusion.

* * * * * * * * *

The ten leading known fire causes in Pennsylvania in the last three years are shown below, the losses given being the amount of damage on property where fires originated (the losses by exposure are omitted):

Rank of Ten Leading Known Fire Causes in Pennsylvania in 1885

1.	Incendiarism	$579,680
2.	Forest and prairie fires	395,075
3.	Lightning	189,241
4.	Explosions (unknown)	181,538
5.	Defective flues	127,457
6.	Spontaneous combustion	113,328
7.	Sparks (locomotive)	108,721
8.	Collisions (railroad)	105,000
9.	Sparks	90,009
10.	*Natural Gas*	72,700

Rank of Ten Leading Known Fire Causes in Pennsylvania in 1886.

1.	Incendiarism	$492,884
2.	Defective heating apparatus	313,832
3.	*Natural gas*	308,028
4.	Friction	268,942
5.	Electric wires and lights	253,600
6.	Sparks	161,426
7.	Lightning	160,175
8.	Spontaneous combustion	135,273
9.	Engines and boilers	105,046
10.	Explosions (oil)	97,428

Rank of Ten Leading Known Fire Causes in Pennsylvania in 1887.

1.	Incendiarism	$631,391
2.	Defective flues	339,620
3.	Stoves	280,094
4.	Overheated and defective kilns	273,006
5.	*Natural gas*	246,033
6.	Lightning	231,490
7.	Spontaneous combustion	153,341
8.	Sparks	106,483
9.	Explosions (unknown)	93,429
10.	Lamp and lantern accidents	87,891

The first thing to be noted, therefore, is the advance of natural gas in amount burned from the tenth place to the third or fifth place. It must be remembered that this is its record *in the whole State*, and that the natural gas region is only a part of the State.

The percentage of natural gas fires of the fires of known origin is shown by the following brief table:

Percentage of Natural Gas Fires.

	Number of fires of known origin.	Natural gas fires.	Per cent. Natural gas fires.
1885	977	10	1.02
1886	932	32	3.43
1887	825	33	4.00

As in the preceding case, it must be borne in mind that natural gas fires amounted last year to 4 per cent. of the whole number of fires of known origin in Pennsylvania; it follows, therefore, that in the natural gas region the percentage of fires from this cause was much higher. If only one-half of last year's fires in Pennsylvania occurred in the natural gas belt, then 8 per cent. of the fires in that section were caused by this gas; if only one-third or one-fourth, then the percentage rises to twelve or sixteen.

The *Chronicle* received reports of 75 natural gas fires in Pennsylvania during the three years ending with 1887, but probably this was by no means a complete record. The following table shows the aggregate number of risks burned and the money losses by these fires:

Three Years' Losses in Pennsylvania by Natural Gas Fires.

Number of fires, 1885–87 (both inclusive)	75
Number of exposure losses by same	78
Total risks burned	153
Property loss by 75 fires	$626,761
Property loss by 78 exposures	273,391
Total property loss	$900,152
Insurance loss by 75 fires	$513,042
Insurance loss by 78 exposures	187,397
Total insurance loss	$700,439

Where these fires originated is shown by the following summary:

Character of Risks where Seventy-Five Natural Gas Fires Originated.

Dwellings	21	College building	1
Schools	5	Woolen mill	1
Iron works	4	Livery stable	1
Glass works	4	Music store	1
Offices	3	Bakery	1
Buildings	3	Brick works	1
Hotels	3	Drug store	1
Barns	2	Gas well	1
Saloons	2	Billiard saloon	1
General stores	2	Restaurant	1
General fires	*2	Brewery	1
Churches	2	Salt works	1
Foundries	2	Barber shop	1
Engine house	1	Storehouse (leather)	1
Steel works	1	Storehouse (tobacco)	1
Hardware factory	1		
Shed	1	Total	75
Spring (steel) factory	1		

*Place of origin unknown.

* * * * * * * * *

Unless it can be shown that natural gas has prevented the burning of more than 153 risks, and a loss greater than $900,152, it must be considered to have increased the fire hazard. It would hardly seem reasonable, however, to expect so active an agent in causing fires to be at the same time instrumental in preventing them. But let us look at the other side of the account.

There seems to have been some decline in the number of fires from ashes and hot coals, but this cause is rarely an important one, and seldom leads to more than nominal loss. Defective flues have lost none of their old danger; on the contrary, the proportion of fires from this cause was larger in 1887 than in 1885. Furnaces appear to have gained a little in number of fires. Open fireplaces and grates seem to be heard from with about the old-time frequency. Overheated and defective kilns seem to be somewhat more dangerous. Overheated and defective ovens remain about the same. Sparks show a falling off. Stoves are, perhaps, a trifle more dangerous. It is difficult, however, to find any lessening of fires or diminution of loss that can be directly traced to the use of natural gas.

The decline in the number of fires in Pennsylvania since 1885 is the strongest statistical argument that the partisans of gaseous fuel can set up in their attempt to demonstrate its comparative safety. But there is nothing in this incident to warrant the conclusion that the use of natural gas has led to this result. The decrease in the number of fires can be accounted for by the fewer fires originating by other causes with which gaseous fuel can have nothing whatever to do.

While it is uncertain that natural gas has had any appreciable effect in preventing fires, it is certain that it has caused many fires and much loss. We think it has caused two fires where it may have prevented one, but the correctness of this conclusion we are willing to leave in doubt

until the experience has been a longer one. Another fact worth mentioning is the larger average loss on property where natural gas fires occurred than on property fired by most other causes.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, May 10, 1888.

How Can(n) Such Things be?—The Imperial-Continental Gas Association and Electric Lighting.—Gas Affairs at Paris.—Gas for the Working Classes.—Two New Inventions.

It is often remarked that truth is stranger than fiction, and the following story may, with some show of reason, be accredited to the fertile brain of a "comic" writer, rather than to the authorities at the disposal of a staid and unromantic compiler of gas engineering items. Although it points no useful moral, nor illustrates no new departure, yet it is worth recording, if only for the humor of the thing. A few weeks since at a corporation meeting held in an important town a councilor arose and made a grave charge against the local gas company in connection with the public lighting. This was paid for on the average meter system, a meter being attached to every tenth lamp. The whole were fitted throughout with 4-foot regulators, but this sapient dignitary had lately made a discovery to the effect that these meter lamps were the object of special attention on the part of the gas company, and that they were specially accommodated with 5-foot regulators. The object, of course, was to convey the idea that the 9 satellites surrounding each meter lamp were also supplied with regulators of equal size, and, in short, to charge the corporation with a great deal more gas than they actually consumed. The surprising part of the affair is to follow. The matter was duly discussed as being of serious import, notwithstanding the indignant repudiation of some shareholders who happened to be present. And when it appeared that the charge was based on information received from one Mr. Jno. McCann, a gentleman who had recently "retired" from the service of the gas company, the matter was not dismissed with a laugh or a few jokes, as might be supposed, but communications with the gas company were opened forthwith. The latter, as might be expected from gentlemen who had nothing to fear, at once demanded a proper testing of all the governors in use, under conditions that would insure the actual truth being arrived at. But meanwhile the corporation took the bull by the horns, by forming a sort of private detective committee, who at once made a raid upon the supposed dishonest governors and removed a number of them. They were bound to confess that the result of their meanly-conducted investigation did not support the charge, and, with this sheepish admission, have sought to drop the subject. This is not a cock and bull story, nor is it an Irish bull. Anyone who wishes proof of its correctness had better inquire at the town hall, Dublin. Meanwhile we may thank the worthy Councilors who have brightened the dry musty records of municipal business routine with an amusing and original little farce. Might not the perambulations of the detective committee be appropriately characterized as the Can-can dance.?

As the policy to be adopted by gas companies in respect to the electric light has lately excited a great deal of interest in the States, I may direct attention to the speech made by the Chairman of the Imperial-Continental Gas Association—Sir Julian Goldsmid, Bart.—on the occasion of the usual half-yearly general meeting of shareholders, which was held in London a few days since. It should be mentioned that this undertaking is a very large one, having a capital of 14 million dollars, and owning 14 gas works in various towns in France, 5 in Holland, 8 in Belgium, 9 in Germany, and 17 in Austria, the head offices being situated in London. The chairman of an undertaking working 53 different gas works, in different towns and countries, may well be regarded as an excellent authority on this subject. In the course of his speech Sir Julian Goldsmid referred at length to the policy adopted by the Company under the peculiar circumstances in which it was placed, the property not being guarded by act of Parliament, as in England, but in most cases protected only by concessions or other agreements made with the municipal authorities of each town. At Vienna, one of the towns where the Company supplies gas, they have recently erected an electric lighting plant for lighting the Opera House, a theater, and the Government buildings. At the last meeting of the Company the policy of this proceeding had been called in question, and the Right Honorable Chairman took the opportunity to reply to the objections that had been raised. Considering the matter from a legal and business point of view, he had foreseen that there would be other developments of lighting to which it would be their duty to apply themselves. In one of their acts they had obtained power to supply other light than that of gas, and in some of their oldest contracts they were bound to supply any new light that might be invented, on satisfactory terms. He strongly supported the introduction of the electric light at Vienna and anywhere else where the interests of the Company would be benefited thereby, even if it was not a profitable affair. But he did not intend to improve the electric light at the expense of gas, or to relax endeavor in the way of promoting and developing the gas business. He mentioned that the late Sir William Siemens, who was a great authority on electricity, as well as on gas lighting, had always maintained that there was a great future for electricity, and that it would not interfere with but promote the business of the gas maker.

The Gas Company at Paris have published their accounts for the year 1887, and they show highly satisfactory results to all concerned, excepting, perhaps, the consumers, who, under any circumstances, must pay a high price for an article of very average quality. I have already alluded in previous letters to the remarkable contract between the municipal authorities and the Gas Company, by virtue of which large sums are paid over to the city exchequer every year. The amount thus transferred for the year 1887 amounts to no less than 3½ million dollars, all of which has to be found by the gas consumers, in addition to the legitimate profits. The sale of gas shows a satisfactory increase, and about 25 per cent. of the total quantity supplied is consumed during the hours of daylight. The total number of consumers at the end of the year was 200,535, of which about 5,500, or nearly 3 per cent. of the whole, were added during the year. The public lighting has also been improved by the erection of more than 1,000 new lamps, and by the introduction of high power burners at refuges and open spaces. A satisfactory advance has been made in the use of gas by the occupiers of "flats." To meet the objection of the first cost of fittings, the Gas Company, besides bringing the service pipe in, put up a light in the kitchen, and also provide and fix a gas stove free of expense. They keep a staff specially engaged in following out new improvements in gas burners and appliances, so as to be in a position to advise consumers as to the best and most economical methods of applying gas for any purpose. The directors have watched the progress of the electric light, and they consider it to be a "light of luxury, deficient in those guarantees of constancy and regularity which are indispensable to the maintenance at all times of the public and private lighting of a large city." They note that the places lighted by electricity in their district number only 293—a mere trifle as compared with the increase of gas consumers registered during the year. These figures, as coming from a city where 13-candle gas is supplied at about $1.50 per 1,000 cubic feet, are instructive. Reference is also made to the use of modern recuperative burners as ventilating agents, and to the desirability of introducing into houses "such arrangements as will allow of the heat produced by the combustion of the gas being used for renewing the air and preserving the salubrity of apartments." If progress as that above indicated can be made under such disadvantageous circumstances, what would be the state of affairs if Parisians were supplied with gas of good quality at a reasonable price?

The favor accorded to exhibitions of gas appliances appears to be unabated, and a great many are announced to be held in various parts of the country during the present month. In each case the cookery lesson feature is retained. The Bristol Gas Company are promoting one on a grand scale, with special attention to the subject of instructing the public generally on the uses of gas. It is stated that the exhibits will number nearly 1,000, including apparatus for heating, cooking and lighting by means of gas. A special feature of this exhibition will be an artisans' cottage, fitted up with appliances for the supply of gas. This idea originated from the fact that of the 60,000 tenements situated within the area of the Company's supply, only about one-third use gas, the remainder employing other means of artificial illumination. The chief objection experienced with this class of customers is inability to afford the initial expense of fittings, meter, etc., and the Company are prepared to remove this difficulty by supplying the same at a small quarterly rental. The cottage will be specially arranged for the illustration of the scheme. This idea of bidding for a particular class of custom, that at present is but small, appears sound and business like; and the results of this enterprise on the part of the Bristol Gas Light Company will be eagerly watched. For they are far more fortunate than many towns in being able to number one-third of the artisan class amongst their customers. In the North of England, I am told, the use of gas amongst working people is more general, but in the South there are whole streets of artisans' cottages in almost every town through which the gas mains are carried only for the supply of public lamps, as there is not a single private consumer. The first cost of meter and fittings is evidently the drawback. As my friend, Mr. White, of Sherburne, has remarked, when a working man and his wife can start housekeeping with an expenditure of only a dollar or so for oil lamps, it is not likely that they will go to an expense of perhaps $10 for gas fittings—to say nothing of the difficulty of arranging the fittings so as to be readily removable in case of leaving. And upon the popularity or otherwise of the means adopted for meeting this difficulty, the degree of success obtained in the introduction of gas amongst the artisan class will largely depend. I hope next month to give some personal reminiscences of the Bristol Exhibition.

One of the old plans proposed for clearing deposits of naphthaline from street mains was to send a dose of superior gas, prepared from cannel coal, through them. This was supposed either to reduce the naphthaline to a

liquid form, leaving it to find its way to the nearest drip-box, or else to carry it forward as vapor in the gas. Anyhow, it disposed of the objectionable deposit in some way or other. This idea, after laying dormant for many years, has lately blossomed in a new direction, namely, as applicable to the clearing of ascension-pipes. A composition, said to be composed largely of refuse animal matter, such as glue, has been introduced in France for that purpose. In this country one engineer proposes to occasionally follow up the charge of coal with a piece of animal fat placed in the mouthpiece. The vapors from the fat are said to dissolve and soften the deposit and bring it down. Another finds benefit from the use of a handful of oily waste. And lately one of our leading coal merchants has introduced a mixture to be used instead of cannel coal, to which he has given the name of "A specially ground oil-coal compound." It consists of certain heavy hydrocarbon fluids ground up with coal dust, and the inventor claims that two charges will clear a stopped pipe, and that an occasional charge will act as a preventative, at the same time increasing the yield per ton and the illuminating power. Thus it is claimed that an effectual cure for this evil has been provided, and that high heats may be safely maintained without the use of any special apparatus or water cooling arrangements. If all this can be realized in ordinary every-day working it will be good news for the stokers, excepting those who secure an extra allowance for each choked pipe. The other invention to which I refer is a tar burner claimed to be perfection itself, and capable of injecting and spraying into any furnace a jet of tar of any desired size, in such a manner as to insure its complete combustion, and this without the aid of steam. Great simplicity and ease of working are claimed, and that tar, used by means of this appliance is worth twice as much as coke. I have not seen this new burner, but if it can do all this there is a good future before it. There is room for a good regulator that may safely be left for 12 hours or so at a time, and that can be relied upon to deliver the tar in such a finely divided form as to insure its complete combustion and absence of any residue in the furnace.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. E. H. MCCULLOUGH, Vice-President of the Westmoreland Coal Company, accompanied by his wife, recently sailed for Europe. Prior to his departure he resigned his position as President of the American Gas Company; and it pleases us to say that his associates in that enterprise at once elected Mr. M. S. Greenough—General Manager of the Company—to fill the vacancy thus created. Hereafter, then, Mr. Greenough will sign himself President and General Manager. In answer to several inquiries, we may say that the Messrs. Carpender, 42 Pine street, New York city, act as Financial Agents for the American Company.

MR. A. B. STANNARD writes us that the "Ohio Department, American Electric Company (Limited)," has been closed. In other words, that the home office in New York city, will be able, for the present, to take care of orders from Ohio, West Virginia, and Kentucky.

THE "Parent Company"—incubators on the "baby system"—seems to be satisfied now with very small game, and we think so from the fact that the Equitable proprietors have incorporated an Equitable Gas Light Company for Flushing, L. I. It is capitalized in $50,000, and the incorporators are returned as R. M. C. Graham, Harry Keene, Malcolm Graham, T. Waln, Morgan Draper, and E. H. Rath. We do not know what sort of men compose the Council or Board of Trustees of this beautiful Long Island town; but we do know that the owners of the Flushing Gas Light Company ought to have no trouble in compiling an array of facts which would prove interesting to the local authorities, if not fatal to the aspirations of the progenitors of the Flushing new gas enterprise. They have left their ear marks in many places, prominent among which appear the following: Utica, N. Y.; Baltimore, Md.; Chicago, Ills.; San Francisco, Cal.; and so on.

BETWEEN the efforts of Proprietor Foley and Superintendent Gerould (who, by the way, is a brother of L. P. Gerould, formely of Manchester, N. H., and now of Monmouth, Ills.), matters are so managed at the Mendota (Ills.) gas works that, on a total annual make of only three million cubic feet, a fair profit is made on a sales rate of $1.50 per thousand cubic feet. Eternal carefulness is a guarantee of dividends.

THE Atchison (Kansas) Gas Company has secured control of the local electric lighting business. The combined plant will probably be worked, in accordance with the policy pursued by Mr. Ambrose at Springfield, Mo., as detailed by that gentleman at the recent Chicago meeting of the Western Association. Brother Kelly can be trusted to make the idea popular and profitable in the city midway of St. Joe and Leavenworth.

THE Eastern capitalists who ventured on supplying Farmington (N. H.) with gas have no reason to be disgruntled at the net result. Last year about 9 per cent. was earned on the investment, 80 per cent. of which return has been invested in main extensions.

MR. C. P. RUSSELL, who during the last four years had the advantage of learning the way in which to run a gas works from no less a tutor than Mr. Beck, of Galveston, Texas, is now acting as Superintendent at Houston, same State. Beck's pupils are usually a credit to his sagacity as an instructor.

THE Fort Plain Gas and Electric Light Company has been incorporated, with the following guiding spirits: Edwin W. Wood, Wm. Clark, Andrew Dunn, D. E. Dunn, and S. L. Philips. This is probably the Company formed from the consolidation of the Meriden Gas Light Company, of Fort Plain, N. Y., and the Fort Plain Electric Light Company, notice of which was given in our last number. It is probable, however, that the new Company will largely extend its original boundary lines, since the group of villages within easy striking distance (Fort Plain, Nelliston, Minden, Palatine, and Canajoharie) can readily be supplied with gas from one central plant.

THE proprietors of the Homer and Cortland (N. Y.) Gas Company, of whom Mr. A. C. Wood, of Syracuse, is quite prominent, intend to practically reconstruct this plant. In fact, if the present intention is carried out the new Homer works will have a manufacturing capacity quadruple that at present possessed. The most approved sort of machinery is to be installed. The distributing system will be improved by the placing of about 3,000 feet of 8-inch pipe. Truly, this is a case of the Phœnix type; for it is not so long since that we were called on to report the damage of these work by fire. Fire does not frighten Brother Wood, however; he is too old a campaigner to be cast down by it. The Colonels and the Barons in the Equitable camp, for instance, can bear testimony to his capacity for executing flank movements.

A CORRESPONDENT sends the following tersely told tale: "The New England Gas Light and Heat Company was organized in Portland, Me., some three weeks ago. President, Roscoe H. Thompson; Treasurer, Samuel G. Lane. Capital, $300,000; paid in, nothing. Par value of shares, $10." Perhaps Mayor Chapman might be induced to "pay in" something when he has finally disposed of the city's holding in the Portland Gas Light Company. If he does, the New England Gas Light and Heat Company might be persuaded to allow the city to name one, or even two representatives in its Board of Directors.

THE following (and all we can say about it is in keeping with the ancient and honorable remark of, "which is important, if true") is from the Philadelphia *Record* of May 20: "The Philadelphia Gas Improvement Company has been chartered in Camden, with W. L. Elkins, Jr., Geo. D. Widener, R. F. Bower, and Rufus E. Shapley, of this city, and lawyer Samuel H. Grey, of Camden, as Directors. The capital is $1,000,000, of which $1,000 has been paid in. A gentleman interested in it says it is intended to be a competitor, probably, of the United Gas Improvement Company, which has been remarkably successful. The incorporators control valuable patents for the making of gas, which are now being experimented with. He further said: 'We went to New Jersey for a charter because it is cheaper, but I do not know that anything will come of it. We only want a charter in case we should decide in the future to push the scheme. There is no intention now to use the Company to secure the Philadelphia gas works.'" We are afraid the latest accession to the ranks of "parent companies" will find it uphill work; for the ground has been carefully gleaned, and the beaches present nothing but an awful lot of dead sea fruit. However, those patents—we are assured they are valuable, mainly, we presume, because still in the adolescent state—may work wonders!

A MONTH or so ago we chronicled the discovery of a thief in Newark, N. J., whose aversion to a gas meter was such that he bye-passed it in order to obtain a supply of gas, and now we are called on to state that another Newark thief had such an affection for gas meters that he felt prompted to remove—to a neighboring junk-shop—one which was quietly resting on the stoop of the premises No. 70 Park street. In order to make this a trifle clearer, it should be said that some meter setters in the employ of the Citizens Gas Company had deposited temporarily the meter, which attracted the thief, on the stoop, while they were placing another in the cellar of the Park street house.

ELECTION OF DIRECTORS, MUTUAL COMPANY, CITY.—The following gentlemen comprise the Board of Directors recently named to govern the Mutual Gas Light Company: C. Vanderbilt, J. P. Kennedy, Geo. J. Forrest, Arthur Leary, John R. Ford, W. K. Vanderbilt, R. L. Crawford, Chas. H. Kerner, Jos. S. Stout, R. M. Galloway, Jos. Harker, E. S. T. Kennedy, Saml. Thorne, Louis de Bebian, Geo. W. Hall, and Lawrence Wells. Not much sign of financial decrepitude in that list.

DESTROYED.—The works of the Hot Springs (Ark.) Gas Light Company were entirely destroyed by fire on the night of Saturday, May 12. The Hot Springs gas men made gas from pine wood, or resinous pine knots, which material is quite plentiful in the immediate vicinity of the plant. About 250 cords of this material were piled up in the yard, and it is supposed the heap caught fire from sparks given off by a passing locomotive. The holder was full of gas at the time the flames started, and the genius in charge thought to save the holder by allowing the gas to escape through the purifying house. This brilliant idea ensured the total destruction of the manufacturing plant, for although the works were well equipped with hose no one could get near enough, because of the heat, to use it. The property was uninsured, but the works will be at once rebuilt, with all the latest improvements, by the Shickle, Harrison & Howard Iron Company, of St. Louis, Mo.

WAY DOWN IN MAINE.—The proprietors of the Rockland and Thomaston (Me.) Gas Light Company met in annual meeting on the 15th ult. The annual reports were quite reassuring to the stockholders, the figures showing that the increase in gas sales, over those of last year, amounted to 20 per cent. Thus encouraged, and in keeping with the promise of a year ago, a resolution was adopted to reduce the selling price from $2.75 to $2.60 per thousand. It was also decided to put in an exhauster, and to enlarge the retort house; the improvements to be completed this summer. The annual election resulted as follows: Directors, Messrs. F. H. Odiorne, A. P. Brown, and A. M. Copp, Boston, Mass.; O. E. Cushing, Lowell, Mass.; and F. A. Dingee, Phila., Pa. Officers, F. H. Odiorne, President; A. M. Copp, Treasurer and Agent. Messrs. Odiorne and Copp are to be congratulated on having such associates as Messrs. Cushing and Dingee; and all are evidently determined to keep faith with the Company's customers.

MR. GEO. H. BRACE, who has been acting as manager of the Sioux Falls (Dak. Ter.) Gas Company—this plant has been through two explosions during its comparatively short term of existence—announced recently that he was pleased to retire from active connection with this enterprise, and was frank enough about it to say that he was not a "practical gas man." The people who succeed him are thoroughly practical gas makers, and Sioux Falls' residents will not be displeased to learn of the substitution. The National Gas Light and Fuel Company, of Chicago, have acquired a controlling interest at the point noted, and it is their intention to put the plant in thoroughly good shape. It is needless to add they will put none but experienced men on guard.

CHANGES IN THE WATERHOUSE ELECTRIC LIGHTING STATION, BALT., MD.—Mr. R. R. Zell, Vice-President and General Manager of the Waterhouse Electric Company, Baltimore, having resigned those positions, has been succeeded by Mr. F. G. Waterhouse. Messrs. H. G. Fledderman and W. T. Biedler were also selected to fill vacancies in the Board of Directors caused by the resignations of Messrs. Zell and Pope.

GAS WORKS FOR SALE.—Mrs. H. M. Fuller, as owner and operator of the franchises and works of the Greenville (Mich.) Gas Light Company, offers the same for sale. Correspondence may be opened by writing to her at Greenville, Mich.

WE understand that the Committee on Lamps, Providence (R. I.) City Council, have been authorized to contract for the maintenance of 175 arc lights, at a price not to exceed 50 cents each per night, The contract is to date from the 15th inst.

SUPT. F. E. BABBITT, of the opposition Company at Macon, Ga, says he proposes to supply the *business portion* of that city with gas on or before the 1st prox. And still, City Councils contend that this sort of competition (!) is not opposition!

CRESSLER'S COMING EAST.—But the following list of contracts recently awarded to the Kerr Murray Company also proves that he does not intend to vacate his Western stronghold, either. The Eastern invasion is represented on the Company's books in the shape of an order from the Paterson (N. J.) Gas Light Company for a telescopic holder 110 feet in diameter, with two 25-ft. lifts. The holder is to have lattice column guide-frame, top and intermediate girders, and 20-in. connections. What is the matter with our holder builders in this section of the country? Other Kerr Murray orders include a single-lift holder (50 by 18 ft.) for the Stratford (Ont.) Gas Company. This vessel is to be inclosed in a brick building, with trussed iron roof. Stratford is also to be fitted with a new set of purifiers, equal to the handling of a per diem output of 100,000 cu. ft. Mr. Gerould signalizes his accession to the management of the Monmouth (Ills.) Gas Company by authorizing Brother Cressler to put up a new holder—capacity, 20,000 cu. ft. New benchwork (5's and 6's) is to be put in at Marquette, Mich., and Huntsville, Ala.; while the Atchison (Kas.) Gas Company has ordered a new multitubular condenser, equal to the task of "refining" a per diem make 130,000 cu. ft. This does not look as if the Atchison folks intended to operate their recent electric light purchase at the expense of or detriment to the carburetted hydrogen division of their business. The entire list also goes to show that Brother Cressler is preparing for his customary summer vacation.

HAS HIS "LIFE'S WORK" ENDED?—The readers of the New York *Tribune* have, for a year or two back, had occasion to wonder why it was that Editor Reid seemed to devote so much "valuable" space to descanting upon the peculiar beauty of Mr. Edwards H. Goff's life's work, especially in connection with the fortunes of the American Electric Manufacturing Company. While uncertain as to the reason or motive for the puffing indulged in, it is nevertheless a fact that Editor Reid's organ (the comic papers have often illustrated how its crank is turned) was among the first—if not the very first—to announce the collapse or relapse which has attended the life's work of Mr. Goff, in so far as that is related to the said Company. Editor Reid's organ thus grinds out the doleful tune: "The American Electric Manufacturing Company, at No. 3 East 14th street, whose factory is at No. 165 West 18th street, had ten judgments, aggregating $19,419, entered against it yesterday (May 24) in favor of the American Electric Works, of Providence, and one for $584, and the sheriff took possession. E. H. Goff, who has been President of the Company for several years, resigned about six weeks ago. H. C. Adams, who has been Secretary of the Company, was elected to succeed Mr. Goff. The Company was incorporated March 28, 1885, with an authorized capital stock of $3,000,000, of which $1,000,000 stock was paid" (not in) "to the American Electric and Illuminating Company, of Boston. Only $500,000 of the capital stock was paid in cash. In October, 1885, the Company purchased the assets of the Fuller-Wood Electric Light Company, of this city, for $125,000." *Vale*, Goff; *vale!* [The judgments were satisfied on May 25, whereupon the sheriff was withdrawn.)

NORFOLK (VA.) AGAIN IN LINE.—Supt. Bates. of the Norfolk City Gas Company, has been stirring up his people again, for we note that they are promptly on time in making good their pledges of last July. When the '87 reduction was announced, the promise was given that it all remained with the people whether or not a similar notification would be promulgated at the end of the twelvemonth; and here is the sequel. The circular says, in effect: "From the 1st of July next the Company will place the selling rate at $1.40 per thousand cubic feet, but bills not paid at the office on or before the 5th day will be made out at the rate of $1.60. Those whose monthly accounts show the use of $50 worth of gas are to secure a rebate of 5 cents per thousand, or a net rate of $1.35. Supt. Bates ought to feel satisfied that his service to his employers has been of the valuable sort. He has been at Norfolk (and Fred Egner knows what sort of a place it is) just 14 months; but within that period the net selling rate has been cut thrice—from $1.80 to $1.35—and the end is not yet, for the pledge of '87 is renewed with the cut of '88. The present schedule is at $1.60 net. Keep it up, Mr. Superintendent, and you will soon have to call again on the holder builders and pipe founders.

DR. VANDENBERG, the City Chemist and Gas Inspector, Buffalo, N. Y., has been engaged for some time past, in accordance with instructions from the local Board of Health, in ferreting out the party or parties responsible for the dissemination of an odor which made the lives of those residing within certain limits of Buffalo nothing short of a burden to them. As the odors complained of were most strikingly prevalent when a visit was made in the neighborhood of the old Buffalo and Citizens Gas Light Companies, the ordinary observer at once charged the offense to the gas makers. However, thanks to the Doctor's patient and unswerving course, it seems after all that the Gas Companies are far from being the chief offenders. In his report on the subject the investigator says that, apart from the odors inseparable from a gas works—and which are neither necessarily noxious nor unwholesome—"the atmosphere surrounding such plants should be as wholesome as that surrounding any dwel-

ling;" and "that the plants of the Buffalo and Citizens Companies are suitable to secure such a condition." The real culprit was discovered to be the A. L. Barer Asphalt Pavement Company, for it is proved that the stench—which, as the Doctor observes, the people in the vicinity assert, they "smell it in their bedding and taste it in their bread"—can be detected only when the asphalt works are operating in a certain division of their "cooking" process. The Doctor says the process can be rendered practically innocuous at all stages if proper care is observed. He suggests certain modifications be made in the asphalt plant, and the Barer Company was only too well pleased to give ready assent to them. Now, if we could only get the Doctor to devise a plan for the fumigation of our own (or the Standard Oil Company's) Hunter's Point! But this is too great a task to set for anyone. Had Leander's right to his niche in the temple of fame depended solely upon his crossing Newtown Creek, after the manner of the finny tribes, we think he would have gained far greater glory than that which accrues to him in consequence of those plunges which he made from his abydosian springboard.

MR. S. A. DRAKE, Supt. of the Canton (Ills.) Gas Light Company, will no longer keep bachelor's hall, and simply for the reason that on May 17, because of a ceremony performed in accordance with the ritual, he succeeded in causing Miss Auraline Snyder to enter into a matrimonial alliance with him. Long may the partnership continue, for Benedict Drake, having been a good bachelor, cannot fail to prove a model husband. When last heard from the happy couple were in Chicago, and although most visitors incline to the view that Chicago is a very fascinating jumble, we understand Mrs. D. is yet in doubt about her opinion on the biggest city of the great Central West.

DR. KENNEDY, whose name has long been identified with the great Breckenridge cannel coal colliery of Kentucky, has passed over to the majority. The Doctor's long life was punctuated by many stirring periods, notable among these being his appointment in 1864 to the Mayoralty of New Orleans, when that city succumbed to the Union forces.

ANNUAL ELECTION, POTTSTOWN, PA.—The annual meeting of the Pottstown Gas Company was well attended, and the shareholders had every reason to be satisfied with the reports of the year's business. The following Directors were chosen: H.G. Kulp, L. P. Evans, Chas. Moore, M. D., J. Kehl, D. H. Heim, C. F. Sisler, W. H. Smith and G. Van Buskirk.

CHARITY AND BUSINESS.—"Brother Enfield may be 'way down in Texas,' but he manages, nevertheless, to keep his eyes wide open several hours out of each 24. Your correspondent has often heard of clever advertising methods, but begs humbly to suggest that Enfield's way of bringing business to the Dallas Gas Light Company rather takes the prize. Gas cooking ought to take well in his portion of the Lone Star State, for the summer months there are—well, to say the least, quite 'summery;' and such conditions prompt the housekeeper to inquire after a method which will produce a quick fire, that, when its mission is fulfilled, can be extinguished with the ease with which it was ignited. Of course, Enfield can always put the housekeeper in the way of getting just the very thing—a well-regulated gas stove. At all events, to show the Dallas gas man's delicate way of increasing the gas output. A very worthy local Association, known as the Library and Woman's Exchange, accomplishes much good in Dallas; but as it takes money to keep such things going, Mr. Enfield suggested that a novel entertainment, in the shape of a gas stove dinner, might put money in the Association's purse. The managers thought so, too, and the details of the affair were speedily arranged. A suitable apartment in the Library headquarters was fitted up with gas stoves, an attractive *menu* was prepared, tickets (at 50 cents each) to the dinner—which was to be cooked in full view of the diners—were printed and sold, and the day and hour for the feast fixed at May 11, from 12 to 3 o'clock. The cooks (volunteers from the membership of the Society) formed a most attractive feature of the occasion, and the affair passed off without a hitch. The attendance was most gratifyingly large; the stoves sustained their reputations; the dinner was excellent; and the Association's fund was augmented in a goodly sum. In the meantime the Gas Company is doing a lively business in its stove department, whereupon I am led to exclaim that nothing succeeds like success, especially when the successful one knows something about the principles of advertising.—R. D." Does Enfield ever sleep?

MR. J. B. HALL, JR., Secretary of the Evansville (Ind.) Gas Light Company, is another of the wideawake fellows who believe in selling gas while the sun shines—the attention of those in the hayseed districts is respectfully called to the meadowy odor of this hint. The Vincennes School of Cookery and Domestic Training having closed for the season—and the President of the Western Gas Association ought to be satisfied with its result, so far—Secretary Hall prevailed on Miss Dodge to repeat the experiment at Evansville, where a most successful two weeks' course in practical cooking with gas was brought to a close last Tuesday. We think the Dallas idea was carried out, to some extent at least, in the Evansville instance; for we note that the programmes bore a line to the effect that the tickets for the series (of which there were two, in 10 lessons each, at $4 for the complete course, or 50 cents for single lessons) were in charge of the Woman's Exchange, a local Society similar in aim to that at Dallas, Texas.

MISS DODGE, by-the-way, is now in the Empire State, having commenced another series of her instructive lectures on domestic economy at Utica on the 1st inst.

DELL'S DOINGS.—John Dell's astuteness as a financier—our readers will remember our veracious account of his masterly bull movement last Fall on the St. Louis mining share market—has in nowise dimmed his capacity for securing fat contracts for the Laclede Fire Brick Company. In April we reported that he had captured Barret's new stacks at Louisville, Ky., and we are now in position to say that he has persuaded Littleton (he who was chained and charmed at Chicago last month) to put in 8 benches of 6's, of the Laclede Company's improved pattern; Coffey, of Peoria, Ills., has also harkened to the tempter, with the result that Dell will build him 7 benches of 6's. The same figurer will equip the Wheeling (W. Va.) works with 12 benches of 6's. The queerest thing about it all, however, is that Dell still occasionally complains of being unable to compete with others in his line.

SPEAKING of contracts of the above nature reminds us that President Hicks, of the Chicago Retort and Fire Brick Company, has ample reason to be satisfied with the share of favor awarded his Company by the manufacturers of the light of the present; and of the future, too. He is now under contract to perform work at the following places: Stack of 12 new benches for the Detroit (Mich.) Gas Light Company, the Hicks regenerative furnace to be installed in 6 of the arches; renewals, etc., for the Companies at Cincinnati, Cleveland, and Columbus, Ohio; Terre Haute, Franklin, and Columbus, Ind.; Winona, Minn.; Selma, Ala.; La Crosse, Wis.; Chicago (Ills.) Gas Trust; Newburyport, Haverhill, Brookline, Wakefield, and Dorchester, Mass.; and Portland, Me. It should be said that in many of the above instances, classed under the general head of "renewals, etc.," the Hicks furnace is to be installed. At any rate, the list shows that President Hicks does not seem to be hampered greatly by the Regan Inter-State *fiasco*; for it is nothing less.

DIAPHRAGM is at hand with the following: "Supt. Baxter, of Evansville, Ind., is to visit Europe this summer, and Mrs. B. will accompany him. They sail on July 1. He has earned his vacation.——Supt. Stratton, of Decatur, Ills., having so arranged matters that his consumers may take a choice out of either coal or water gas, or arc or incandescent light, is now deeply immersed in putting a roof over his own head. Someone has said that three removes are equal to a fire, and Stratton has reached the fire stage. What makes it all the worse is that each hegira was caused by the desire of a newly-mated couple to ensconce themselves in the house of his choice. Hence his wish to be a house-owner. In due time we may look out for a royal housewarming. Just as a straw, I drop the hint that he has let a contract for a new bench of 6's.——When Supt. Cannings has completed his new benchwork at Henderson, Ky., he will make connection between the old plant and the new condenser and scrubber put in late last fall. An 8-inch Roots exhauster has been ordered.——The man from Quincy is up to his ears in plant betterment work. The Secretary says that his experience thus far (an even 6 months) in the supplying of arc lights is quite satisfactory.——President Bixby, of the Galena (Ills.) Company, reports a large increase in business. The Stacy Manufacturing Company are under contract to put up a new holder at this point, and the Parker-Russell Company have been ordered to put in new benches of 5's. Truly, Galena grows.——Supt. King, of Jacksonville, Ills., does not consider that he is experimenting now in the electric light line. No, sir; he looks on this portion of his business as a permanency. The fuel gas furore, however, does not seem to have moved him so strongly; and while on this subject, it strikes me that Mr. Faben's questions—anent the lack of a bonanza in natural gas at 20 cents per thousand, which were quietly asked by that gentleman during the discussion of Mr. Critchlow's paper at the Sandusky meeting of the Ohio Association—were in reality un-

answered; or did the questions answer themselves? The Jacksonville corporation is spending a good deal of money on street repaving just now, and this will necessitate a considerable expenditure for main relaying.——The Owensboro (Ky.) Company has assumed possession of its new plant; and it is a gem. Excepting Paducah, and possibly Louisville, Owensboro can boast of the best equipped coal gas works in the State. Mr. Canley, late of Lebanon, is in charge.——The Sioux City (Ia.) Company is figuring on an electric lighting plant. Supt. Kellogg, during his visit to the Chicago convention, had many interviews with the electricians. He will put in a bench of 5's. The office of the Company has been moved uptown (on Pearl street), and the Superintendent intends to push the gas stove business with his characteristic zeal. The new office will assist him greatly in that intention.——Mr. F. E. McMillin, Treasurer and Superintendent, has leased the Nebraska City (Neb.) works for a period of 5 years from the 1st inst. The town is growing rapidly, and the venture ought to prove a profitable one.——Among those who were warmly welcomed at the Chicago meeting was President Warmington, of the Peoples Company of Cleveland. Mr. W. had but recently returned from an extended trip to the Slope, and was much benefited in health by his wanderings.——The legal moves in reference to the Chicago Gas Trust are absolutely bewildering. To-day it is one thing; to-morrow, just the reverse. Still, the lawyers are happy, and Mr. Forstall does not seem greatly cast down. The bondholders, in fact, are the only ones whose features seem 'sicklied o'er with the pale cast of thought.' To complicate matters still more, the City Council has been asked to grant a franchise to the Chicago Fuel and Light Company, which will, in case of favorable action, construct a huge plant near the Brighton division of the city—southwest. Thus and so it goes.——Marietta, O., is to have a huge celebration, on the centennial order, next July, and the upper branch of the Buckeye State Legislature will lend its dignity, in a body, to the affair. The gas men are bestirring themselves to rise equal to the occasion. They are to put in the McKay-Critchlow process, and will make many other improvements."

THE corporation of St. Louis, Mo., is agitating the subject of the city's taking a hand in, or assuming entire control, of the manufacture and supply of artificial light—both gas and electric. Capt. Keiser, of the Laclede Company, is quoted as saying the city can lease that plant—provided the city's terms are satisfactory to the Company's proprietors. Of course, the Captain is sensible to the last.

THAT suit of the Leadville (Col.) Illuminating Gas Company, in which the plaintiff seeks to recover from its ex-President—ex-Senator Tabor, whose main reliance as a legislator was based on the gorgeousness of his night-shirts—the sum of $43,761.72, because of an alleged wrongful retention of moneys in connection with a certain issue of the Company's bonds, is again occupying the attention of the local courts. The ex-Senator put in a cunningly worded defense, the chief merit of which was its speciousness.

THE heirs of Thomas O. Murphy, who was killed in Utica, on May 11, through a shock occasioned by contact with one of the Utica Equitable Gas and Electric Light Company's electric light wires, have brought suit for damages against the offending Company. Mr. Murphy's heirs value their late relative at $5,000. Perhaps it might be wise to compromise the claim; for juries are never lenient with corporations in cases of this kind. Notoriously is this so where a gas company figures as a defendant.

THE Badger Illuminating Company, of Milwaukee, Wis., has been ordered by the Board of Public Works to sink all its electric conductors, which cross "the navigable rivers and canals of the city" to a depth which will admit of the free and uninterrupted passage of vessels of all descriptions. Harbor Master James Trowell discovered that one of the Company's cables crossed the Milwaukee river at a depth of 14.2 feet whereas the law insists that no crossing shall be made, unless at a depth of 22 feet; hence the Board's action.

WM. HENEY, the Mayor of Jackson, Miss., invites proposals for lighting that city with 30 arc lamps. It is specified that the work of installation must be completed by October 1st. Proposals are to be made to Jno. T. Bruce, City Clerk, and the competition will close on July 1st.

MESSRS. MAHLON H. DICKINSON and E. H. Levy have been elected Directors, or Trustees, on the part of the corporation, in the Northern Liberties gas district of Philadelphia.

ON Monday next the Trustees of Saratoga Springs (N. Y.) will award the contract for street lighting for the term of a year from August 15. The village will require 430 gas lamps (to have 4-foot burners, to be lighted on each night and all night, the gas to have a photometric value of 20 candles) and 115 specimens of the kerosene variety.

A FORTNIGHT ago we noted the purchase of a controlling interest in the Shreveport (La.) Company, by Mr. Jno. P. Ryan, of Birmingham, Ala., who is also President of the Columbus (Miss.) Oompany. After the transfer was made Mr. Ryan was chosen President; Mr. W. B. Hamilton, Vice-President, and Mr. W. E. Hamilton, Secretary and Treasurer. Thos. Byron, formerly with Supt. Egner, at St. Louis, Mo., was appointed Superintendent.

BUT two bids were submitted in response to the San Francisco Board of Supervisor's inquiry for supplying the public buildings with gas light for the ensuing fiscal year. The bidders were the Pacific Gas Improvement and the San Francisco Gas Light Companies, each offering to furnish a 17-candle power light at the rate of $1.75 per thousand cubic feet. At present the same concerns are maintaining the lighting, the task being about equally divided.

WE understand that work on the Anniston (Ala.) plant is going along swimmingly under the combined direction of Secretary Reed and Engineer Hayden. Messrs. Bartlett, Hayward & Co., of Baltimore, Md., are to build the holder, and these energetic constructors will be put to their trumps to finish their part of the task by the time appointed—early in July. They know how to follow suit, however.

THE Marshall (Texas) Electric Light and Power Company is wondering what "it was begun for, that it should be so soon done for." Eleven different liens have been filed against it, although the total of same is just short of $1,200.

MR. W. S. CARROLL, Vice-President of the Consolidated Gas Company (Balt. Md.), in company with his accomplished wife, sailed for Europe last Saturday, per steamship Umbria, from this port.

FROM *Life*.—Mrs. Hayseed (in hotel room)—"Joshua, why, for the land's sake, don't you put out that light and come to bed?" Mr. Hayseed—"Well, durn it all, Maria, it says, 'Don't blow out the gas,' and I'm dinged if I kin find any snuffers."

WE understand that General Manager McMillin is getting ready to install the Claus plan (or something akin to it) of purification in closed vesssels at the works of the Columbus (Ohio) Gas Light and Coke Company. By-the-way, we would like to say to Mr. McMillin that our compositors were not suffering from an overdose of interrogation points, but rather from a lack of exclamation marks. It was intended, with an exclamation mark in parenthesis, to call attention to his verdict in respect of the reliability of incandescent lamps; for he will remember that, having come to this very line in his address, when reading the same to the Western Association last month, Kinsley's type of the incandescent lamp suddenly refused to incandesce.

SUPT. AND MANAGER TRACY, of the Poughkeepsie (N. Y.) Gas Light Company, is not to be outdone in the matter of attempting to increase his day sales. A circular recently issued to the residents of the city conveys the intimation that the Gas Company will supply and install any desired size of the Cone gas stoves at net cost to the Company, and will then supply all gas used in the stoves at the rate of $1 per thousand cubic feet. This is progress with a vengeance. There is scant comfort for electricians in announcements of the Poughkeepsie sort.

PRESIDENT LEETCH, of the Georgetown (D. C.) Gas Light Company, announces that, beginning with 1st inst., the Company will supply gas at the rate of $1.50 per thousand. In case accounts are not settled within 7 days from date of presentation, a penalty of 25 cents per thousand will be imposed.

ABOUT a week ago that portion of Brooklyn, N. Y., which drains into the inky stream known as Gowanus canal, was startled by an explosion in the works of the Fulton-Municipal Gas Light Company. It appears that one of the smaller naphtha tanks on the plant exploded, but no great amount of damage was occasioned. This happy termination, however, should not blind the authorities of the city to the fact that the storage of naphtha in such large quantities, particularly in a district like that bounded by Union and Douglas streets, Nevins street and the canal, is a constant menace to an important factory interest located within the boundaries named.

[OFFICIAL REPORT.—Continued from page 347.]

Eleventh Annual Meeting of the Western Gas Association.

HELD AT CHICAGO, ILLS., MAY 9, 10, AND 11, 1888.

FIRST DAY—MORNING SESSION.—MAY 9.

Mr. Frederic Egner, of St. Louis, Mo., here read a paper on

THE PURIFICATION OF ILLUMINATING GAS IN CLOSED VESSELS.

Having been called upon to prepare a paper to be read at the eleventh annual meeting of the Association, the writer selected as a subject "The Purification of Illuminating Gas in Closed Vessels."

Although to write a paper and then apologize for having done so is hardly in accordance with the writer's convictions, yet it seems to him he ought to explain to the Association that he is fully aware of the fact that much abler men have written on the same subject, and that his paper is, in consequence, to a great extent composed of extracts from the London *Journal of Gas Lighting*, and from answers to letters of inquiry sent abroad, and therefore embraces only a very little independent investigation.

The selection of subject was made not because the writer is particularly familiar with the process of purification mentioned, but, since the object of our meetings is to benefit each other and the companies we serve, or unofficially represent here, by a free interchange of opinions as to results in our respective experience, on matters brought up from time to time for discussion and consideration, it was thought that others who had not given these comparatively new processes of purification much attention might become interested and proceed with the investigation, which progress would lead at last to a desirable end. Furthermore, that such of our members who may not have time or inclination to investigate all new things presented to the consideration of practical gas makers so frequently of late years may, to some extent, be informed, in the least space of time, as to the practical aspect of the most promising one of these new processes for the purification of gas in closed vessels.

Strictly speaking, we purify gas in "closed vessels" now; but these vessels or purifiers must be opened frequently to remove the spent material rendered inactive by reason of having become fully saturated with the impurities, so called, which it was intended to take out of the gas, and then to recharge these purifiers for future use.

By purification in closed vessels is meant a process by which the removal of the undesirable constituents of the gas treated is effected continuously, or without ever opening the apparatus to replace the purifying agent, such as lime or other material. In fact, the gas is purified by the very gases we wish to remove; and, in the case of one of the processes hereinafter mentioned, we are able to add the sulphur taken from the gas to the residual products of our works.

Purification with lime is so well understood that the practice need not be described, even by way of review; and the same may be said generally as to the use of iron oxide in its various forms—thanks (as to the latter) to the efforts of Prof. Douglas, of Ann Arbor, Mich., and the Messrs. Connelly, of Pittsburgh, Pa.—so far as we of the West and South are concerned, at least. By using iron oxide in one shape or another, purification in closed vessels has been nearly reached; for the revivification of the material without removing it from the boxes has been accomplished, and the revivification of the material, while the gas to be purified was passing through the purifiers, has been claimed. In the latter case it is said that the thing is done by passing about 3 per cent. of air through the purifiers with the gas. That is to say, the advocates of that way of purifying tell us we may use 3 per cent. of air in the process, and that this really seems to benefit instead of injuring the gas, besides effecting the desired constant revivification of the material in the boxes, until the same becomes surcharged with sulphur and must be removed for good and all.

That method of purification would alone give plenty of material for a good and interesting paper, but cannot be further touched upon now by the writer. In the *Journal of Gas Lighting*, London, Eng., issue of June 28, 1887, there appeared, among the "Patent Notices," the following: "Purification of Coal Gas.—Claus, C. F., of Wimbledon, Surrey. —Nos. 7,580 and 7,584, June 5, 1886." From said article, which was illustrated with eight figures showing the apparatus in detail, I quote the following paragraph, which tells the object of the invention:

"In the specification of patents, No. 2,838, of 1881, and No. 4,644, of 1882, methods are described for the purification of coal gas by means of ammonia, derived from the gas itself, and for the separation and utilization of bye-products; and the present invention has reference to certain improvements whereby the gas can be almost completely purified in closed vessels by ammonia (and water) only, without lime or other chemicals, and with better utilization of bye-products than heretofore."

Then follows an elaborate description of the apparatus and process. The same paper contains a notice of another patent bearing on the same subject. These papers interested the writer to the extent of inducing him to enter into correspondence with parties in charge of the process in England, and of carefully looking up all information possible to be obtained, with the intention of bringing the matter before the proper officers of his Company, with the view of introducing the process at their works if the results likely to be obtained would warrant the necessary expenditure.

Although it would take up too much of the time of this Association to give in full all the articles relating to the method of purification more particularly referred to in this paper, and known as the "Claus Process," it seems desirable that the dates of said publications should be given. In the columns of the London *Journal* previously mentioned we find, on p. 438, vol. XLIX. (March 9, 1887), a comparison of the "Claus Process" and of another, viz., that of Mr. W. Young, of Clippens. On pp. 1,123, 1,168, 1,169, and 1,171 of the same volume we find detailed descriptions of the apparatus and its arrangement, as described to the British Patent Office. On p. 133, in Vol. L. of the same *Journal*, we shall find an editorial commentary, the opening paragraphs of which are as follows: "The Claus Process for purifying gas in closed vessels is one of the matters which every gas man in the Kingdom confesses to be of the first importance as a question of the day in gas engineering. It is felt to be coming, this revolution which is to banish dry lime and oxide purifiers, and replace them with scrubbers and pumps. What we are particularly anxious for all our readers to realize is that this impending change is at their very doors." That, gentlemen, is an expression of opinion in the editorial columns of what the writer, at least, believes to be the best and most valuable of all the periodicals published abroad devoted to the interests of the gas industry. On p. 197, same volume, there is an article by Prof. C. W. Heaton, F.C.S., F.I.C., describing a number of the chemical points of the Claus Process.

On p. 577 of same volume and *Journal* will be found a communicated article, by Messrs. Heaton and Watts, describing the whole apparatus in a simple manner. This is done by assuming that a plant adapted for the purification of 5 million cubic feet of gas per diem is required. It is stated that the calculations incorporated in the article are the result of experience gained with the experimental plant (at which 20 tons of coal were carbonized per diem) at the Windsor Street Gas Works, Birmingham, from which the plant in course of erection at Belfast (4 million cubic feet capacity per diem) has been designed. The plant is described as in three portions: 1, gas purifying plant; 2, ammonia plant; 3, sulphur recovery plant. And to these may be added: 4, ferrocyanide or sulphocyanide plant; 5, sulphate of ammonia plant. These are considered, in turn, in the article mentioned, which concludes with a recapitulation of the advantages claimed for the process, of which the final ones only will be quoted. These are: "1, economy of space; 2, economy of cost—the cost of the Claus purifying and sulphur recovery plant is not more than from one-half to two-thirds that of dry purifyers; 3, avoidance of waste and nuisance from the opening of dry purifiers; 4, removal of bi-sulphide of carbon; 5, avoidance of lime, and the risk and nuisance arising from it. These advantages are so obvious that it is unnecessary to do more than to allude to them. They will be appreciated by every gas manager."

On p. 571 of the volume and *Journal* mentioned before will be found an able editorial article under the caption of "The Claus Process Completed."

Now, having always endeavored to "keep up with the procession" (pardon this apt, if inelegant, expression), the writer asked the Editor of the *Journal of Gas Lighting* for the address of the parties controlling the invention, and was referred to Mr. Francis Arding, No. 5 St. Jeffreys Square, St. Mary Axe, E. C., London. Mr. Arding was asked for more particulars than the newspaper articles mentioned contained, and in the course of our correspondence Mr. Arding was furnished with figures showing the present cost of purification to us at St. Louis; the writer also made an estimate of the possible cost of the apparatus required with the Claus Process at St. Louis, for a capacity of 2 million cubic feet per diem. The general dimensions of the apparatus and number of vessels required were estimated from the descriptions in the papers previously referred to, and the cost was estimated partly on actual bids made to furnish some of the work, and partly on the known value of some of the material and machinery supposed to be required. That these figures were not far out of the way the following letter will show. It will also show about all the information that could be obtained up to

date without purchasing the patents and operating the process.

(*Copy of Letter.*)

"THE AMMONIA GAS PURIFYING AND ALKALI CO., LTD.,
5 JEFFREYS SQUARE, ST. MARY AXE,
LONDON, E. C., March 14, 1888.

"MR. FREDERIC EGNER, Laclede Gas Works, St. Louis, Mo., U. S.A.:

"Dear Sir—I have the pleasure to acknowledge the receipt of your letters of Feb. 20 and 23, with estimated cost of apparatus for the Claus Process of gas purification for 2 million cubic feet per 24 hours, amounting to the sum of $36,587.30. This very nearly corresponds with the figures I have already given you—namely, £8,000 for a plant for 2 millions, and is so far satisfactory.

"What I should strongly advise you to do is to instruct us to prepare the necessary drawings and specifications for the requisite apparatus. This will cost you £200—that is to say, 2½ per cent. on £8,000—and will save you a lot of trouble.

"But reading between the lines of your letter, I gather that you have not yet sufficiently grasped the subject, and appreciated the advantages to be gained, to enable you to lay the matter before your Directors and advise its adoption. I will endeavor, as concisely as I can, to make it clear to you and show you its advantages over your present system of purification.

"At present your cost, as I understand, is, for lime, say 20 cents per ton of coal; labor is something—say 2 cents. To this must be added loss of gas and danger in opening and closing your purifying boxes, loss of illuminating power in consequence of admission of air during this operation—something? Against this you sell your liquor for 28 cents per ton of coal, thereby yielding a profit of something between 4 and 6 cents—say 5 cents.

"By the Claus Process of purification the cost of labor, fuel for the generation of steam, and all other incidental charges, will be less than 6 cents; the royalty, 6 cents; say, total cost, 12 cents per ton of coal.

"Against this, you will have your ammoniacal liquor, 28 cents per ton; sulphur, 6 cents per ton; sulphocyanides, 5 cents per ton; showing a total gain of 27 cents per ton of coal carbonized, instead of 5 cents by your present process.

"But, in addition, there will be no loss of gas, danger of explosion, loss of illuminating power, or nuisance. Your ammoniacal liquor will be carbonate and not sulphide; it will have a better market value; and if you like to make it into sulphate you can do so in open saturators—the effluent gas, being carbonic acid only, may pass up your chimney direct.

"There is yet another point which we have never yet said much about, but which, in my opinion, is of great importance—I refer to the preservation of the plant. In your gas liquor you have sulphide of ammonium and prussic acid, which decompose iron, producing ferrocyanide. In the Claus process the sulphide of ammonium is converted into poly-sulphide, and the destructive action upon the iron is arrested. I am, dear sir, Yours very truly, FRANCIS ARDING, Secy."

The ordinary dry lime purifiers, to take care of 2 million cubic feet capacity per diem, would cost at St. Louis, at present, about $16,000. But the question of first cost would be really insignificant in view of the many advantages and profits from residuals claimed by the new process. These you can work out for yourselves. Practically, of these the writer knows no more than what has been presented to you, with the hope that the writer has added to your pleasure and profit thereby. It should be stated that it has been implied by the inventors or promoters of the Claus process that it is applicable to works of all sizes. The first cost of the apparatus seems to be more than double that of the ordinary lime or oxide purifiers, in this country at least, and not one-half as much, as was claimed in England; but my impression is that by using the Claus process the "Standard" or other like scrubber can be dispensed with. In that case the difference in first cost would not be so great. It has also been stated to me that all condensers and scrubbers now in use could be used in connection with this process, all of which would go far to lessen the first cost of same. As to the profits to be gained by using this or any other process, it has been the writer's experience that local conditions affect all calculations connected with such improvements; hence that part of the subject is left to your own private consideration.

Discussion.

Mr. King—I understand the President has been giving this matter considerable attention. We would like to hear from him.

The President—He is excluded from speaking on this occasion; but Mr. Faben can give us further information.

Mr. Faben—I do not know as much about the subject as Mr. Egner has told the Association. I do not think I have anything to say. I was very glad to listen to Mr. Egner's paper. I asked for information on the Claus' plan at the meeting of the Ohio Association, and Mr. Page then gave a partial description of the process. Having been asked if he could state what impurities were absorbed, or were not disposed of, he promised, if it was the wish of the members, to familiarize himself with the results of the process, and present them to this Association at this meeting.

The President—Have you not purified your gas in closed vessels, either by the Claus' or some other process?

Mr. Faben—In part only. We used a preparation of iron and sawdust; and, during the time of making gas, we passed in about 1 per cent. of atmospheric air, with very good results. We have, during the summer season, passed over ten million cubic feet of gas without changing the boxes. During the winter time, when the gas is being passed through the boxes much more rapidly, we were not able to do so well, having probably to charge the boxes for every two million feet passed. My experience has been very satisfactory, and I have no hesitancy in recommending others to try the experiment.

Mr. Jenkins—What difference in candle power does the introduction of 1 per cent. of air make.

Mr. Faben—It is scarcely noticeable; but if there is any difference at all it is in the line of improvement.

Mr. King—You will remember at one of our former meetings this subject was brought forward, and it was then suggested that it might be all very well in England, where a 14 or 15-candle gas is supplied; but that in this country, where an 18 to 20 candle gas is demanded, it was not practicable. Mr. Faben's experience seems to be entirely contrary to that idea. It is a matter in which I have been very much interested; and, so far as I can gather from foreign journals, it has received a good deal of attention in England, where the practice is considered by a great many to be a success. If there are any other gentlemen in the room who are using air I would like to hear their experience.

Mr. Faben—I know there has been some discussion in England about it, and I think it is generally conceded there that the admission of air is rather damaging to the candle power.

Mr. Lansden—Did I understand Mr. Faben to say that the addition of 1 per cent. of air improved his candle power?

Mr. Faben—I said the difference in candle power was scarcely noticeable—if anything, an improvement was shown. We more frequently changed our purifiers on account of back pressure than on account of impurities passing—even in the first box. It is not uncommon in changing the purifiers to find in the upper box 6 or 8 inches of the iron material still a good strong oxide, but the material below is so closely packed that the resulting back pressure on the works obliges a change to be made. In other words, we change because of the pressure and not on account of impure gas.

Mr. Brown—How would that be affected if a larger amount of air were passed?

Mr. Faben—I think an increase in the amount of atmospheric air would be detrimental to the quality o the gas. In our first experiments I passed the air through a meter and graduated it to 1 per cent., which quantity we passed in. If we increased the amount there would be a noticeable diminution of the illuminating power of the gas.

The President—I think, in England the advantage derived from the introduction of air in this oxygen process has generally been accompanied with the lime process, which has somewhat complicated it. The process was, at first, mixed up with a patent, and probably did not receive the same encouragement at first that it does now. The great benefit of the lime process is due not to the lime but to the air they put into the retort.

Mr. King—It seems to me one serious obstacle was the regulation to a nicety of the amount of air introduced, especially in smaller works. In large works, where there are enough retorts to keep the amount continuously made somewhere near even you can regulate it; but I do not see how it can be done automatically even then. In small works, where the charges are put in once in 5 or 6 hours, considerable gas being made at one time and not so much at another, I think much difficulty would be experienced in this matter of regulating properly the air admitted. Mr. Lansden reminds me he has had a like experience in that line, by revivification *in situ*.

Mr. Lansden—I can state my experience in a very few words. I wanted to establish the principle of revivifying in the box. I knew the Messrs. Connelly had had some experience in that line; but also knew that in doing so a tray had taken fire and burned up. I, therefore, put in some iron trays, and knowing that sawdust would burn, I used broken brick, and oxidized the latter with iron filings, placed the mixture 18 inches deep in the purifier, and revivified it five times. We had a ther-

mometer in the center to ascertain the heat. While I was attending one of the Association meetings the young man left in charge undertook to perform the revivifying process in a shorter time than I had done—I usually allotted 5 hours to the operation. When he inserted the thermometer and started the fan he broke the former instrument, whereupon he went off to an optician's to purchase another, allowing the fan to run for 20 minutes. At the end of this time he discovered the thing was on fire on the inside; and by the time he got the lid off and the hose on he found that the iron had melted sufficiently to run together. He had "black-oxidized" every bit of the material; and, as it would never "come back" again, we used it for setting retorts.

Mr. Shreve—That reminds me of a trouble I had one winter. My holder got down and my heats also. I have a steam-jet exhauster, and a tap in a three-quarter-inch hole, on which I have a pressure gauge. Not caring to draw in air through my retorts, I thought I would take off the pressure gauge, and draw the air in through the three-quarter pipe. I ran it in that way for about a week, and my candle power did not seem to suffer. We had changed our purifiers every other day; but during that week or ten days our gas showed clean, although the oxide material was not changed in that space of time.

Mr. Jenkins—Do you still continue that process? If not, why did you stop?

Mr. Shreve—I stopped because I wanted to put the pressure gauge back again to tell me what my exhauster would do. (Laughter.)

On motion of Mr. Lindsley, a vote of thanks was tendered to Mr. Egner.

The Association then ordered a recess, to terminate at 2 P.M.

First Day—Afternoon Session.

The afternoon session was opened by Mr. Walton Clark, of Kansas City, Mo., who read his paper on—

FUEL GAS.

Had not natural gas forced upon the attention of manufacturers and gas men the advantages of gaseous fuel, the subject of this paper would not now be agitating the minds of the fraternity. For many years we have preached the utility and economy of gas cooking stoves and heaters in a half-hearted way, hardly dreaming of the immense possibilities in that line lying just beyond the (then) range of our vision. Within the past five years we have read, in the flaring light of the great wells in Pennsylvania and Ohio, the prophecy of the future of our own business, and our thoughts are now turned to the study of the problem, the solution of which will soon be demanded of us, "What is the mixture of gases best adapted to meet the fuel wants of the probable patrons of the companies we represent?"

The demand for fuel gas comes from householders, from manufacturers—from everybody who has use for heat or power. I think, however, we must not hope to supply them all with fuel from our works. Blast furnaces, rolling mills and other large consumers of fuel could more cheaply manufacture their own gas, having, among others, the great advantage of using it at the high temperature at which it is generated, purification in their case not being necessary. While, as gas engineers, our field is as broad as the demand for heat, as managers of local works our operations will probably be confined to domestic heating, cooking, illumination and power; and the gas best adapted to meet the wants of housekeepers, users of power, and the smaller manufacturers, will, I think, prove most remunerative to us in the end. What is this mixture? The properties most desirable are evident. Its composition should be such that the maximum of heating effect may be distributed at minimum pressure, through mains of minimum size; hence its specific gravity should be as low, and its calorific value as high as consistent with economical production. It should yield the highest practicable flame temperature, that it may be used to the greatest advantage for incandescent illumination and power, as well as for its direct heating effect; hence, it should be composed of combustible gases only. It should burn with the least possible nuisance, therefore it should be free from sulphur compounds. So far, I think, the conditions are fulfilled by a purified mixture of coal and water gases, in about the proportions in which we can produce them from bituminous coal, and that such a mixture will also answer the remaining condition—that the gas must be produced at a cost to make its selling price commend it to the consumer. I am aware that such a gas as I have described cannot be produced at as low a cost per 1,000 cubic feet as can one containing a large percentage of nitrogen, and that, heat unit for heat unit, it will cost somewhat more; but from its applicability to all fuel purposes, its lower specific gravity, and its higher flame temperature, I believe it to be more economical to produce and distribute, and better adapted to meet the various wants of our consumers, than any mixture containing a large proportion of producer gas.

Any substance which enters into combination with atmospheric oxygen, producing heat in sufficient quantity for application to economic uses, is a fuel; and a gas which answers the above description is a fuel gas. Two such substances only are found in the gaseous condition, hydrogen and carbon, and any other, except as it may be necessary to maintain the carbon in the form of gas, is a hurtful diluent. Carbon is gaseous, as far as it concerns our subject, only in combination with hydrogen or oxygen, and of its combinations with the latter only carbonic oxide is combustible. Therefore, for a pure fuel gas we are limited to hydrogen, carbon in combination with hydrogen and carbonic oxide, and in proportion as we introduce other substances does our product cease to be a pure fuel gas.

A ton (2,000 pounds) of average bituminous coal has a heating power of about 27,000,000 units. In its conversion to gas a large part of this heating power is lost; how much depending somewhat upon the kind of gas we convert it into.

To compare the relative efficiencies of two mixtures, one of which shall be, as nearly as the exigiencies of manufacture will permit, a pure fuel gas; and the other, a mixture of coal, water and producer gases, with the incombustible diluents the last named contains, is a simple problem.

From a ton of coal we obtain by distillation 10,000 cubic feet of gas, 1,300 pounds of coke, and 100 to 120 pounds of tar; 300 pounds of coke must be burned to distill the coal, unless, as I think, we should find it profitable to burn our tar. Let us estimate the tar at 100 pounds, and burn it. I have found the relative heating value of tar and coke under retorts to be as 8 to 5, nearly, and 100 pounds of tar will equal 160 pounds of coke. Therefore, we will consume only 140 pounds of coke in distilling our coal, and have 1,160 pounds left for conversion into gas. This may be treated in one of three different ways—it may be all converted into water gas, or into producer gas, or a mixture of the two. To convert it into producer gas would give us about 69 per cent. of the heating power of the coke in the form of an admirable fuel for use unpurified upon the premises where generated, and before it had lost the heat which it brings from the producer. Such is the Siemens gas, and the furnace gas in our generator benches. It is not fit, however, for storage and distribution, because of its enormous bulk compared to its heat efficiency, its low flame temperature, and the difficulty of keeping it alight when used in small quantities. Converted into water gas the coke yields about 54 per cent. of its efficiency to the gas, which to the advantage of small bulk adds that of high flame temperature and heating power per cubic foot. This, I believe, will be found more advantageous to produce from the coke and mix with our coal gas to make the final product, fuel gas. Producer gas alone being out of the question, we have left to compare the two mixtures, coal and water, and coal, water and producer gases. I shall estimate the consumption of coke per 1,000 cubic feet of water gas at 40 pounds, for I believe this figure can be attained. Its heating power I estimate at 290 heat units per cubic foot. I estimate the producer gas at 95 heat units per cubic foot, and its volume at 95 cubic feet per pound of coke. This quantity seems very large, but from the analysis of producer gas I am led to the conclusion that it is correct. I allow 13 per cent. weight of the fuel for ash and cinder, and my own experience convinces me that this is a very liberal figure. In the mixture of coal, water and producer gases I will estimate on the conversion of 33⅓ per cent. of the coke to producer gas.

We can now compare the relative values of our two mixtures, taking the amount produced from 2,000 pounds of coal as a basis:

Mixture of Coal and Water Gases.

All the available coke (1,160 pounds) from a ton of coal converted into water gas.

	Am't cu. ft.	H.U. per c. f.	Total H. U.	Flame Temp're.
Coal gas.....	10,000	630	6,300,000	4,348° F.
Water gas.....	29,000	290	8,410,000	4,797° F.
Total	39,000	377	14,710,000	4,480° F.

Specific gravity, 507.

In estimating flame temperature an excess of 20 per cent. of air is allowed.

Mixture of Coal, Water and Producer Gases.

⅔ of the coke from 1 ton of coal being converted into water gas.
⅓ " " " " " " into producer gas.

	Am't. cu. ft.	H.U. per c. f.	Total H. U.	Flame Temp're.
Coal gas.....	10,000	630	6,300,000	4,348° F.
Water gas.....	19,350	290	5,611,000	4,797° F.
Producer gas....	37,000	95	3,500,000	2,961° F.
Total.....	66,350	232	15,411,000	4,048° F

Specific gravity, 751.

The loss of heat from the conversion of one ton of coal into coal and water gases is 27,000,000—14,710,000 = 12,290,000 heat units, or 45.5 per cent. In the conversion into coal, water and producer gases, the loss is 27,000,000—15,410,000 = 11,589,000 heat units, or 43 per cent. Thus, if, as I believe, we have in these figures a fair comparative statement of the amounts of heat utilized in the two mixtures, in order to save to our product an additional 2½ per cent. of the total heat of the coal, we have increased its volume from 39,000 cubic feet to 66,350 cubic feet, or nearly 70 per cent., and reduced its flame temperature from 4,480° to 4,048° F.

It is principally upon this increase of bulk and reduction of flame temperature that I base my objection to the admixture of producer gas. We must provide storage room for a portion, and a very considerable portion of our gas. The amount, whatever relation it bears to our daily output, will necessarily be increased in proportion to the amount of gas required to supply a given demand for heat. To supply this demand will require of the mixture containing producer gas 60 per cent. more than of that containing only coal and water gas, and render necessary 60 per cent. more holder capacity. There is, of course, a pressure at which it will be found most advantageous to deliver this gas, and at that pressure the carrying capacity of our mains must be 60 per cent. greater for the more bulky mixture to deliver the same amount of heating power. This estimate makes no allowance for the difference in specific gravity, which would make the comparison still less favorable to the producer gas mixture.

As stated, in the conversion of a ton of coal to a mixture of coal and water gases there is a loss of 45.5 per cent. of the theoretical heat efficiency of the coal, and unless we can show that this is more than made good by the increased availability of the heat units of the gas, we will be compelled to advocate the use of our product simply upon the score of convenience, neatness, and saving of labor. Very important items are these, but to command the market I think it will be necessary to demonstrate something more.

Upon the authority of M. Claudel, in the most efficient method of heating apartments the utilization of heat from coal is only 13 per cent. of the amount generated; and from this it runs down to less than 3 per cent., 10 per cent. is a liberal estimate. The ability to almost exactly regulate the supply of air to a gas fire, better to arrange radiators and reflectors, and to utilize the heat of the products of combustion more fully, makes a gas fire much more economical in the utilization of the heat developed. In a paper* read before the Gas Institute in 1880, Mr. Travers detailed his elaborate experiments to determine the efficiency of gas cookers and heaters. He found it to vary from 32 per cent. to 77 per cent., the variations being due to different styles of stoves. Let us take 50 per cent., then, as the efficiency of gas as a heating agent, in comparing it with the coal from which it is made.

A ton of coal, with a total heating power of 27,000,000 heat units, 10 per cent. efficiency does useful heating to the extent of 2,700,000 heat units.

The gas from a ton of coal, 10,000 cubic feet coal gas, 29,000 cubic feet of water gas, with a total heating power of 14,710,000 heat units, 50 per cent. efficiency, will yield 7,355,000 heat units. Thus we see that in useful heating effect the gas from one ton of coal is equal to 2.7 tons of raw coal when applied to domestic heating. In the generation of power we have a comparison somewhat less favorable to our product. I think from the record of steam engine performances we will not be far wrong in assuming that the average consumption of fuel per horse power is not below 4, yielding 54,000 heat units, one ton of coal burned under a boiler developing 500 horse power in the cylinder of an engine. This is less than 5 per cent. efficiency. Dr. Slaby, of Berlin, in a report comparing the Lenoir and Otto gas motors, says that he has found the efficiency of an Otto 4-horse power engine to be 16 per cent., the number of heat units necessary to the development of one horse power being 16,025. Thus the gas from a ton of coal will yield 917 horse power per hour. Therefore, for the production of horse power one ton of coal converted to gas is equal in value to 1.83 tons burned under a boiler. I am aware that much better results have been obtained in the steam engine than I have given, but I believe the average efficiency to be below the figure assumed; and better results than Dr. Slaby's are obtained every day with gas engines. Great as is the efficiency of the gas engine as compared to the steam engine, there is yet more to be said for it. Dr. Slaby accounts for the heat generated in the cylinder of a gas engine thus:

Converted into work	16	per cent.
Abstracted by cooling water	51	" "
" " expelled products	31	" "
" " conduction and radiation	2	" "
	100	

*See JOURNAL, Vol. XXXIII., Sept. 16, 1880, p. 127.

More than half the heat is carried away in the water, the only object attained being the cooling of the cylinder to permit lubrication. The possibilities of improvement in the gas engine are, therefore, great, and will not cease when this 51 per cent. waste has been prevented. The steam engine has, on the contrary, almost reached its limit of efficiency; and every year will see it less able to compete with its constantly improving rival, the gas motor.

There is another application of fuel gas to economic purposes which I will consider—incandescent illumination. There is no doubt of the success of this method of lighting rooms. I have seen 2½ cubic feet of coal gas burned under a Welsbach mantle develop as much light as 6 cubic feet of the same gas in an ordinary open burner. This and similar burners will settle the question of how to sell illuminating and fuel gases though one set of mains.

For this purpose the gas must be purified from sulphur compounds. This country uses large and increasing amounts of acid made from imported sulphur. The utilization of spent oxide in the manufacture of sulphuric acid will, and in some works even now does, make its cost to gas companies *nil*. The free oxygen in our gas, or the addition of a small amount thereto, will effect continuous revivification at no cost of handling. Thus I believe that in all works of magnitude the cost of purification will be limited to interest and repairs.

Having considered the character and applications of fuel gas, we can estimate the amount necessary to supply a city of a given size. I learn from what I consider a reliable source that the consumption of coal in a Western city and its suburbs was 400,000 tons in 1887. One hundred and fifty thousand tons of this was for domestic use, or about one ton per head of population for heating and cooking. The proportion of the 250,000 tons used for manufacturing, which we could supplant with gas, is difficult to get at; I estimate it at 100,000 tons. Supposing that two-thirds of the population become our customers for all their fuel supplies, we will have a demand for gas for domestic heating equivalent to that supplied by 100,000 tons of coal.

We have estimated that the gas from one ton of coal is equal in domestic service to 2.7 tons of raw coal; therefore, to do the work now done by 100,000 tons will require the gas from 40,000 tons, about. We have estimated that for the production of power the gas from one ton of coal is equal to 1.83 tons burned under a boiler. Therefore, to supplant 100,000 tons used for steam power will require the gas from 54,000 tons, about—I estimate that 12,000 tons will supply all the demands for illumination. Therefore, the gas from 106,000 tons of coal should as nearly supply all the demands for light, heat and power as my figures and suppositions are correct.

The consumption for power will not vary materially with the season; but the difference between the Winter and Summer domestic demand will be as great as between the amount of fuel used to heat a house and cook for its inmates, and for the mere cooking. With a house to heat, a blizzard on, and the mercury 25° below zero, surely the consumption is six times what it is in July, with the mercury at 90° in the shade. The demand for power per day, 300 days per year, will require the distillation of 180 tons of coal, producing 7,000,000 cubic feet of gas, about. The domestic demand will require a mean of 110 tons of coal a day, or 4,290,000 cubic feet of gas, about. I do not think it unreasonable to estimate the maximum at three times the mean. This would be 12,870,000 cubic feet—add the consumption for power and we have a total maximum sendout of 20,000,000 cubic feet. With the liability to unexpected drafts on our holders from sudden changes in the weather, we would require large storage room. Fifty per cent. of the maximum sent out would probably do, or about 10,000,000 cubic feet.

I do not desire to say anything as to the probable cost of the gas. That is readily figured out for any locality, cost of coal and labor being known. In estimating it we should avoid figuring on slack coal at its present price. If fuel gas is generally used, and made from slack coal, the price per ton will rise. With improved furnaces and the introduction of fuel gas, the demand for slack, stimulated by its low price, will soon compel miners to advance their rates to protect the trade in lump coal. If we make fuel gas from screenings, every ton we use will stop the sale of 2½ tons of lump coal. Dealers will find a way to even this up, and the simplest way is to raise the price of the screenings.

I think the direction in which invention in this field will find its richest harvest is toward the perfection of an apparatus for the distillation of coal, and conversion of its residual coke into gas, in the same vessel. Labor and coal go to make the bulk of the cost of gas, and were it all made in one vessel both would be economized.

In working out the heat problems connected with this subject I have arrived at results* differing materially in some instances from those pre-

*See JOURNAL, Vol. XLVII., Nov. 15, 1887, p. 811.

sented to the American Association, in October last, by Mr. McMillin. For instance, I give the heat units per cubic foot of coal gas as 630 about, while he finds it to be 735 about.

I append a table showing the data upon which I have worked, and for which I am in large part indebted to the calculations of Mr. Rollin Norris, M. E. The fuel values are upon the authority of Favre and Silberman.

Data on which the Foregoing Calculations are Based.

	Heat Units per Cu. Foot.	Heat Units per Pound.	Weight per Cu. Foot.	Specific Heat at Constant Pressure by Weight. Water, 1.0.	Flame Temperature.
H	328.7	62,032.0	0.00530	3.4046	....
CH_4	1008.3	23,513.0	0.04288	0.5929	....
C_2H_4	1585.7	21,343.0	0.07425	0.3694	....
CO	320.8	4,325.0	0.07417	0.2479	....
CO_2	.....	.....	0.11727	0.2164	....
H_2O	.....	.....	0.04745	0.4750	....
N	.....	.....	0.07450	0.2440	....
O	.....	.....	0.08480	0.2182	....
Air	.....	.....	0.0767	0.2377	....
Coal gas	630.0	20,701.0	0.0302	.....	4348
Water gas	290.0	6,961.0	0.0420	.....	4797
Producer gas	95.0	1,301.3	0.0730	.....	2961
Water gas mixture.	377.2	9,736.0	.0389	.....	4480
Prod. gas mixture	232.3	4,046.0	.0570	.....	4048

Analysis.

By Volume.	Coal Gas.	Water Gas.	Producer Gas.	Water Gas Mixture.	Prod. Gas Mixture.
H	46.00	50.0	3.5	48.97	23.46
CO	6.00	40.0	26.0	31.28	27.06
CO_2	1.50	5.0	2.5	4.10	3.08
CH_4	39.50	....	....	10.13	5.95
C_2H_4	3.80	....	....	0.97	.57
N	1.20	4.0	67.5	3.28	38.99
O	....	1.0	0.5	.74	.57
H_2O	2.00	....	....	.51	.30
	100.00	100.0	100.0	99.98	99.98
By Weight.					
H	8.06	6.3	0.26	0.0667	2.16
CO	14.71	70.6	26.37	0.5964	34.86
CO_2	5.82	14.0	4.01	0.1236	6.27
CH_4	55.99	....	....	0.1117	4.43
C_2H_4	9.33	....	....	0.0185	.735
N	2.95	7.1	68.79	0.0628	50.455
O	....	2.0	0.57	0.0146	.84
H_2O	3.14	....	....	0.0062	.25
	100.00	100.0	100.00	1.0005	100.000

Discussion.

The President.—One of our new members, Mr. Burdett Loomis, of Hartford, Conn., is said to have given considerable attention to the subject of fuel gas. We would like to hear from him.

Mr. Loomis.—I hoped that this discussion would have gone on at some length before you called upon me. I would really prefer to hear the ideas of other people. Of course I have my own views about it, as I have been interested in the matter for a number of years, and have accomplished some results which are satisfactory to myself. In the first place, in order to be a success, fuel gas must be made and sold cheaply. There may be a difference of opinion as to what that figure may be. I was interested, as some of you know, with Prof. Lowe in his series of experiments at Lynn, Mass., where we were making fuel gas and selling it at 50 cents per thousand. At that price, for some purposes—for gas engines, and for cooking—it was cheaper than coal used in the same way; but for heating purposes it was not as cheap as coal. In fact, coal was considerably the cheaper. We found, as the result of our experiments, with coal at the prices for which it was selling in New England, that fuel gas must be sold certainly as low as 25 cents per thousand to make it a commodity that the people would use. Even at that price, for some purposes, it is still dearer than coal; but for a variety of uses about the house, such as cooking and heating, with the improved stoves and burners that have since come on the market, it is more economical than coal. Where coal is $5 or $6 per ton, fuel gas at 25 cents per thousand is cheaper than coal for accomplishing the entire work performed about the house—I am speaking now about fuel water gas, minus any admixture of either producer or coal gas. In some metallurgical works I have found that at 30 cents per thousand it was cheaper than coal. Extensive experiments have been carried on in a large Ohio factory, and I hoped that the party who conducted these experiments would be here, for he could speak more definitely about them. We found that, at thirty cents per thousand, the gas was cheaper than the coke they had been using. It was on the result of those experiments and others, I base my calculation that about 25 cents per thousand is what we must figure on; and you must at that price sell a good fuel gas—equal to water gas, or better. The water gas can be made from soft coal slack, and a large amount of coal gas can be added in the process of making; in that way a strong calorific value will be added to it, and the gas will be strongly odorized. The writer of the paper (which is a very interesting one) takes the grounds that the coal gas should be made separately, and afterwards mixed, but I contend that the gas should be made entirely in one operation, and in one generator, and the heat units obtained from making coal gas should be mixed with the water gas. The coal should be all put into one hopper, and the gas made taken into the holder by one operation; and we should utilize the heat units that are thrown off in the operation for firing the boilers, or use it for metallurgical work. In all our cities to-day we have plenty of places for using up whatever producer gas may be made, even if the gas company had no use for it on their own account. My opinion is that the gas companies should not only make illuminating but also fuel gas. I am not one of those who believe that fuel gas, incandescent burners and the electric light, are going to do all the business. I think we shall continue to make illuminating gas to a large extent. There will be plenty of business in the future for incandescent lights—both electric and gas. There are many different forms of burners which make good light, and they will undoubtedly be improved. I contend that every gas company should not only make fuel gas and illuminating gas, but should also use the waste gases for making the electric light. There are waste gases enough from the making of gas in any town of any size to run all the electric light that is needed in the town. I find from actual experiments that we can make, from a ton of soft coal (like Ohio, Illinois, Iowa, or Pennsylvania slack,) from 40 to 45,000 feet of water gas, and that the producer or generator gas from that same ton of coal will furnish 250 horse power for one hour—that is, 25 horse power for ten hours, and which will furnish power for 25 arc lights for ten hours. We get that amount of power from the producer gas at present, and I think we are going to get still better results. In that way the units of heat are used pretty effectually. It has been stated that parties do not make the amount of producer gas claimed, and that there has been no way of measuring the producers gas accurately. We are now building some holders and apparatus for measuring not only water gas but also producer gas. The water gas has been measured, but not the producer gas, except as it was tested through the exhauster in the best way we could. We have tested it in metallurgical works, and for heating steel ingots, side by side, and in comparison with the Siemens and the Wellman producer gases. From a ton of coal we got from 30,000 to 40,000 feet of water gas, and we heated as much steel with the producer gas from it as the gas from the Siemens or the Wellman producer did from the full ton of coal.

The President.—Will you give us the proof of that.

Mr. Loomis.—I will show it to you, and prove it. We have no waste. Everything is made into gas. There is nothing left, except ash. A pipe, 400 feet long, that ran to the furnace for two months, on a steady run, and when taken down and cleaned out, we did not get more than half a bushel of dust out of it. This was at the Disston Saw Works, at Philadelphia, Pa.

Mr. Clark.—I would like to ask Mr. Loomis the amount of heat units to the cubic foot in the gas he made, and which he says must be sold for 25 cents.

Mr. Loomis.—I figure that it is equal to good water gas, mixed with some coal gas.

Mr. Clark.—About 350 heat units to the cubic foot?

Mr. Loomis.—Yes.

Mr. Clark.—With regard to the sort of apparatus with which this gas should be produced, I think you misunderstood me. I think (as you do not) that the coal gas should be separated and handled separately. I differ from you in that. I think the coal gas should be handled separately, but that it should be all made in one vessel, or in one cylinder; the coal gas to be drawn off separately, and handled separately. If you pass coal gas through a bed of incandescent fuel you convert it almost into water gas. It goes out practically as water gas. I find the heat units in coal gas to be 630, and in water gas to be 290 per cubic foot. You get more cubic feet of gas, but you get less heat efficiency by passing coal gas through incandescent fuel. Therefore

you require more storage room, and more main capacity to distribute an equal amount of heat.

Mr. Loomis.—I do not pass the coal gas through the hot coal. I said I made it in the same vessel; but I do not pass it through the hot coal. I make them in the same vessel, and then carry them off together, or separately, as I like.

Mr. Clark.—Then you make coal gas and water gas; and the mixture of the two has not more than 300 heat units?

Mr. Loomis.—I do not say that. I said gas equal to water gas should be sold for 25 cents. I said it could be made better than water gas by adding coal gas to it.

Mr. Clark—Then your gas has higher heat efficiency than 300 units per cubic foot?

Mr. Loomis—Yes.

Mr. Clark—The gas I figure on, which has an efficiency of 377 units, cannot be sold for 25 cents per thousand, with coal at $4 per ton.

Mr. Loomis—It can be if you can make it cheap enough. If you want to make gas of 300 heat units, and to sell it for 25 cents, it can be done. But you cannot do it by taking first class coal and volatilizing it in the retort. The coal that is cheapest at the place where it is used is the coal to be made into gas, and get the best results you can in one apparatus.

Mr. Clark—Do you think the price of slack will remain as it is now if we use a large quantity in the manufacture of fuel gas?

Mr. Loomis—Perhaps not.

Mr. Clark—You will use then for making fuel gas a very large proportion of the amount of coke burned.

Mr. Loomis—But if you take the regular run of coal in this part of the country you will find it is not very high priced. It will be higher, of course, if you use more of it; but it will bring the other down to nearer a level. There is plenty of cheap coal to be found in most parts of the country at the present time.

Mr. Clark—I figure that that gas would cost us more than 20 cents per thousand.

Mr. Loomis—Then it is costing you too much to make it.

Mr. Egner—With regard to the fuel gas question, using bituminous slack, and all that, I would like to inform the gentlemen present that we have had a process and an apparatus at the Laclede gas works for over two years, with which you can make fuel gas, water gas, or producer gas, and use cannel coal or any kind of slack. We did it two years ago. If any gentleman wants to buy the patent for doing it let him call on me and I will sell it very cheap. Some late inventors have copied after Egner.

The President—Is that the reason you want to sell?

Mr. Egner—No; that apparatus originated in this way. A water gas man who came to us wanted us to pay $50,000 or $60,000 for a patent for making water gas. I recognized the fact that coal gas was the cheapest and best for us at that time, taking into consideration the cost of anthracite coal, oil, etc., but so that we might have a water gas apparatus also, I invented one; and, in order to prevent anyone else taking and using my invention, I got a patent on it. We built the apparatus and ran it for a month right straight through—there are gentlemen present who have seen it running. We have taken Pittsburgh slack, Illinois slack and cannel coal, and from it have made water gas, producer gas and fuel gas in the apparatus. We ran the apparatus for over two years. If any member of the Western Association wants to buy the patents cheap let them call on Egner. There are three patents; they are all right, and are as good as any of them.

Mr. Zimmermann—The results claimed for the production of water gas rather astonish me. The author of this paper figures on 50,000 feet per ton of coal, and I find that Mr. Loomis, who has just discussed this paper, has, besides his water gas, probably more than its equivalent of producer gas. It is quite well known that for the last year we have been making experiments with fuel gas; and we have been making them very much in accordance with Mr. McMillin's paper read at the meeting of the American Gas Light Association in New York, last October. We are now, however, using a single vessel in which we make a mixed gas. We find we cannot get 50,000 feet of water gas from a ton of coal; I doubt if we can even get 40,000; and the best we have yet done is 35,000. I have heard of no better results from any plan where the figures were given me by uninterested parties. Certainly, it is not done abroad; and I have doubt about its being done in this country. With regard to the wasted excess of the producer gas (having heat units which can be burned over and above what is used for making the gas), I wish to say it requires every bit of that heat, and more too. You are obliged to absorb all of the heat of the excess coming over from your generating vessel in order to obtain enough heat units and enough steam to make your water gas, run your apparatus, and supply heat for all the steam about the place. You have not only got to burn your producer gas, but you have to absorb the heat from the gases in order to obtain enough steam to run your works. The greatest economy is effected only when the excess of heat is just equal to the heat required to furnish the steam for the place. If you have any heat over, it is waste. If you have too little you will have to supply it with coal anyhow. So I think the greatest economy is effected in making the gas only when the waste products are just equal to what is needed to give you just steam enough to run your establishment.

Mr. Loomis—I would like to say with regard to this that I have an apparatus running, at Turner's Falls, Mass., every day in the year, except Sundays and holidays, and anybody can see it at any time. The apparatus is not only making its own steam to make this water gas, but it is furnishing what steam they need for running the engine; also, making 35,000 feet of water gas, and producing 25-horse power 10 hours every day from the waste products. Anybody who wants to see how it is done can do so. The place is not locked up and no cards of admission are required. It is open to the public all the time. We use soft coal—Cumberland slack. We have used all kinds—Ohio, Virginia, dust and anthracite, and mixtures of all of these. We are now testing Illinois slack. I am not stating anything that cannot be seen, and there are gentlemen in this room who have seen it.

Mr. Burt—I will vouch for what Mr. Loomis says, for I saw it three weeks ago.

Mr. Zimmermann—How is that gas measured?

Mr. Loomis—We are measuring the water gas in the holder, not through a meter. It is being used, not once in a while, but each and every day, by the forge men. They have to have the gas ready at seven o'clock, and they are using just so much every hour in the day. The measurement is as accurate as measurement can be. Each forge is running every day, and they have not stopped for a year. I want to say another thing with regard to my apparatus for making gas. I am running a gas generator and making water gas, and am doing it without clinkering. Our water gas generator has been running for nine weeks, and has not had a clinker bar inside of it in that time. I do not know why it will not run for a year without clinkering.

Mr. Egner—We are doing the same with ours.

Mr. Clark—I suppose that Mr. Zimmermann speaks of charging with cold fuel?

Mr. Zimmermann—Either cold or hot; I have tried both.

Mr. Clark—Did you find any difference?

Mr. Zimmermann—Yes; we got about 35,000 with the hot, and from 32,000 to 33,000 with the cold.

Mr. Clark—I know of a water gas producer that is running on cold fuel, and it is running considerably under 50 pounds per thousand, but they are, however, laboring under several disadvantages. In the first place, they admit a large amount of steam, and so carry away a large amount of heat from the generator. According to my figuring it would reduce the fuel account to 42 pounds to the thousand by charging with hot fuel.

Mr. Zimmermann—Is that fuel water gas?

Mr. Clark—Yes; pure water gas. Producer gas is used for heating water for the boiler. It is afterwards carburetted; but the water gas is made in the retorts separately. It is straight water gas and measured cold.

Mr. Loomis—I have seen 60,000 feet of water gas made from a ton of coal.

Mr. Zimmermann—I have made over 70,000 feet on a week's run.

Mr. Clark—This record is of a month's run. The record is made up every month. I was in charge of the generators at the time, and believe the figures to be correct.

The President—I do not want to question the statements of anyone; but everyone should be careful to know that he is correct in his statements. One gentleman vouched for Mr. Loomis's statement. I do not think it is necessary that anyone should vouch for Loomis; but it now turns out that Loomis, instead of measuring the gas by meter, was estimating it in the holder. Therefore the gentleman could not have known whether Mr. Loomis's statement was correct or not. Measuring gas in the holder is a very uncertain thing. I am sure none of us will count very much on the holder. I will refer to one matter to which Mr. Clark has called attention, and that is that he gets but 630 heat units from coal gas, whereas I get 735. This is a vast difference, but it can easily be reconciled. He puts his hydrogen gas at 62,032, and his marsh gas at 21,343; I put marsh gas at about 26,383—which is quite a difference. Now, one-quarter in weight of the marsh gas is hydrogen, and one-quarter of 62,032 is 15,508; three-quarters of the weight of the marsh gas is carbon; three-quarters of 14,500 is 10,875; and the product of the two

added together makes the quantity that I gave—26,383. He takes the tables as worked out when the combustion is of the compound gas, which in the tables that we have in our text books is not so great as the heat units given by the elements. He takes the compound table, while I take the elements and work from them. That is where the difference comes in. Those who have worked out these tables pretend to tell us what the compounds of marsh gas will give; but in many instances they do not give the other compounds. I presume it is fair to put all upon the same basis, and to figure all of them from their values as elements, instead of figuring some of them at their values as elements and others as compounds. I put all on the same footing.

Mr. Zimmermann—I wish to call attention to the remark of Mr. Clark concerning slack coal. There is very little advantage in ever using slack if you cannot work it with perfect ease, because in making 40,000 or 50,000 feet of fuel gas per ton of coal the item for coal is the smallest in the case, and amounts to only 2 or 3 cents per thousand feet. So it makes very little difference whether you use lump coal, slack, or anything else.

Mr. Clark—It takes pretty good coal to give those figures.

Mr. Chollar—I would like to ask Mr. Clark about the matter of flame temperature. Are the flame temperatures which he has given based upon the theoretical composition of the gas?

Mr. Clark—Yes; but with the addition of 20 per cent. more air than is theoretically required, which makes the flame temperature of the producer gas equal 4,048.

The President—I referred in my address this morning to some bold statements; but the weight of evidence this afternoon seems to indicate that those statements were possibly correct. Statements have been made here which are pretty nearly as strong as the ones to which I referred. I hope, therefore, you will pardon me for detaining you a moment while I give the absolute that is possible ever to be obtained. In the production of producer gas we take one pound of carbon and add to it 1.333 pounds of oxygen plus 4.4 pounds of nitrogen, which gives us 6.75 pounds of gas for each pound of carbon used; or, deducting ash, say 6 pounds for each pound of coal used. This gas when cold, or at 60° F., weighs 12.5 feet per pound. Then 12.5 multiplied by 6 gives 75 feet per pound of fuel; and this multiplied by 2,000 pounds, or one ton, gives 150,000 feet as the utmost that can possibly be made. Pure water gas weighs about 40 pounds per 1,000 feet. Then $40 \times 50 = 2{,}000$ pounds; showing that 50,000 feet weighs one ton. How much coal must be used to produce this, using none for condensing the steam, but all being used exclusively for the decomposition of the steam? One pound of carbon, plus 1.333 pounds of oxygen, plus 0.167 pounds of hydrogen, equals 2.5 pounds of gases for each pound of carbon. Reduce this 10 per cent. for ash in the coal, and we have 2.25 pounds of gas for each pound of fuel. Then, $2{,}000 \div 2.25 = 888$ pounds of fuel. The absolute essentials, therefore, of the two (50,000 feet of water gas and 150,000 feet of producer gas) equal 2,888 pounds; that is, coming from 2,000 pounds of coal—I do not know where the last 888 pounds comes from—the absolute essentials of the two equal 2,888 pounds; and, practically, it will take more than 4,000 pounds to make the 150,000 feet of producer gas and 50,000 feet of water gas.

Mr. Clark—If you will take the analysis as I have given it, or as you gave it in your paper last October, and figure up the amount of carbon in a cubic foot of gas, and divide that into the amount of carbon in a ton of coal, and allow 13 per cent. for ash, you will find that you will have 95 feet of producer gas per pound. All the coal which goes into the producer in making producer gas comes out either as gas, or as ash through the grate bars. If you allow 13 per cent. of ash, I do not see how you can escape the conclusion that you make about 95 feet per pound of coal.

The President—I am taking it theoretically, and I say it is absolutely impossible to make more than 150,000 feet of pure producer gas.

Mr. Clark—If you figure it out in that way you will find you only allow 50,000 feet of producer gas, and still have the carbon to account for.

The President—I am taking the absolutely pure producer gas.

Mr. Clark—But taking this analysis that you published, or that is given here, of producer gas as ordinarily made, or as good as we can make it, you will find there are 95 feet to the pound.

Mr. King—As I understand it, when you put in a fresh charge you will not get any producer gas until that gets heated up in a measure. Where will you start to make your measure; and where will you end?

Mr. Clark—It is supposed to be straight running. At the time of firing up you lose a certain amount; but in making producer gas you do not fire up more than once in six months.

Mr. King—But you are continuously charging, and introducing cold fuel; and that must be brought up to a certain heat.

Mr. Clark—You charge small quantities, and the production goes right on. It commences immediately, and goes right on.

Mr. King—And that is available for use?

Mr. Clark—Of course you do not realize anything like all the heat units in the coal; but you get all the carbon in the coal into your producer gas, minus what goes through the grate bars. We charge in small quantities, and work right on regularly, using whatever comes from the coal.

Mr. Zimmerman—Do you count the tar which you make?

Mr. Clark—I do not figure that in the producer gas at all. I am figuring the producer gas on the coal alone.

On motion of Mr. Howard, a vote of thanks was passed to Mr. Clark.

Mr. B. E. Chollar, of Topeka, Kansas, read his paper, entitled

A PARADOXICAL BOX.

The use of water for the purification of illuminating gas dates back to the time of Murdock, who "washed and purified it previous to conveying, through the pipes called mains, to the mills." Later on, Clegg added lime to the water in the gasholder tanks, but the difficulty of removing the spent lime prevented the continuance of this practice, and it was superseded by the use of lime water in special vessels.

As a process, preliminary to the complete purification of gas, the use of water is based on a fact discovered during the early days of gas lighting, namely: That water by the aid of the volatile alkali may be made to absorb many times its own volumes of impurity.

In 1817 Wilson obtained a patent for the purification of coal gas from sulphuretted hydrogen by means of ammoniacal gas, which he mixed with the coal gas in its passage to the gas holder, the compounds being removed by passing the gas through a perforated plate placed under the surface of water. Soon afterwards "breeze boxes" made their appearance, chiefly for the removal of the tar; and the wetting of the breeze in the boxes soon developed the scrubber, which maintained the post of honor for many years.

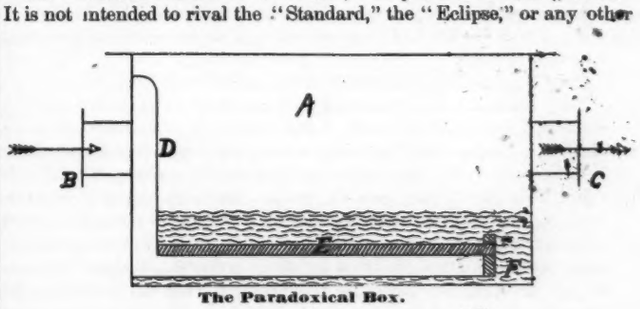
Latterly, however, a compound apparatus, quite properly styled "Washer-Scrubber," has been rapidly introduced, until it now bids fair well nigh to displace the ponderous scrubbers of older date. A distinctive difference between the two styles of apparatus (washer and scrubber) may, perhaps, be defined as follows:

In a washer the water is contained in a body, and is equally permeated—homogeneous, so to speak—in regard to the impurity absorbed. In the scrubber the gas and water are caused to flow in opposite directions; clean water entering at the outlet end and discharging in a fouled state at the inlet.

Since the impurities in the gas are more or less volatile, it is plainly impracticable, with a single working, to get both well-washed gas and a strong liquor.

With a complete scrubber, however, the preliminary purification may be completed at one operation; for the strongest liquor, coming at first in contact with the foulest gas, becomes charged to the maximum extent, and gradually decreases in strength in the direction opposite to the flow of the gas, until, at the outlet, the scrubbing is completed with water very slightly, perhaps not at all charged with alkali.

The "Paradoxical Box" is a washer; "only this and nothing more." It is not intended to rival the "Standard," the "Eclipse," or any other



The Paradoxical Box.

form of good scrubber; but its field, if ever it have one, will be to satisfy the requirements where a more elaborate apparatus may be deemed superfluous.

In construction it is simplicity itself, being hardly more than a modification of Wilson's arrangement of the submerged plate.

An application for a patent might, perhaps, develop the fact that the same thing has been "invented" several times already; but since no such purpose is even contemplated, it is possible that the thing may pass, for a while at least, as a new idea. The paradoxical part of the affair is

that the water stands in a sieve and is supported by the gas, which occupies the whole of the space immediately under it.

In the diagram (see p. 383) *A* represents an oblong box fitted with a removable cover; *B* is the gas inlet and *C* the outlet; *D* is a hood, gas tight, and extending the whole length of the box and to about 3 inches from the bottom, terminating with a "square root" angle iron, looking towards *C*. This angle iron is extended at the same level, nearly across both ends of the box, forming a horizontal ledge, on which rest three sides of a wooden frame, *E*, to the bottom of which is fastened a metal screen. The fourth side of the frame is placed a couple of inches from the outlet side, is secured to the under side of the metal plate, and extends thence nearly to the bottom of the box, leaving sufficient space under and around it to permit a free flow of water over the top of the plate. Fine wire cloth (such as is commonly used for window screens) has been found to answer fully as well as perforated metal.

In operation, the box is filled with water up to, or a little above, the level of the sieve; the gas, entering at *B*, displaces the water below and forces it to flow around *F* and over the tops of the plates, where it stands at a steady level—the gas passing upwards in minute bubbles through the thousands of holes in the sieve. An ordinary adjustable overflow is arranged so as to maintain any desired depth of seal.

A new wire cloth will be required once in three or four months, the cause of the clogging up of the meshes being due to the deposit or retention of insoluble lime compounds mixed with tar. This trouble, however, is not serious; for the cost of a new sieve cloth is only about 50 cents, and it can be put in place in an hour, or thereabouts. Moreover, a complete stoppage of the meshes would result in no harm, for the gas would simply pass under the frame.

The condenser used in connection with this washer is a horizontal spiral, consisting of about 700 feet of cast iron pipe arranged in compact form. It removes nearly all the tar from the gas before it enters the washer.

The gas operated upon is from Kansas coal, and carries a larger proportion of sulphuretted hydrogen and carbonic acid than can easily be found elsewhere, there being no less than 3½ per cent. by volume of each, or about 2,200 grains of the former, and 2,800 of the latter in each 100 cubic feet.

The condenser and washer perform about one-eighth, and the lime purifiers the remaining seven-eighths, of the work of purification. The washer removes almost the last trace of tar from the gas; so completely, in fact, is this the case that the lime trays, after seven years of constant use, are not yet soiled with tar. The condition of the consumers' meters, and of their fixtures as well, bear concurrent testimony—favorable to the good work done by the "Paradoxical Box."

Discussion.

Mr. Forstall—At the north station of the Chicago Gas Light and Coke Company a washer constructed on this principle has been at work for 6 months, and any gentleman here who would like to see it in operation can do so. The principle was taken from a German patent, and the washers were made by the Bouton Foundry Company here. Within 3 months I suppose 5 or 6 million feet of gas per day will be passed through those washers.

The President—What is your opinion of their value?

Mr. Forstall—We like them so well that we are going to put them in wherever we can.

Mr. Chollar—That is our experience, gained after 7 years' use.

The President—That Germany may not have all the honor of this invention, I would like to know if this patent is more than seven years old. Mr. Chollar says he has been using the washer that length of time.

Mr. Chollar—We first tried it in the spring of 1881.

Mr. Forstall—It has been in use for several years, not only for tar washing, but also for ammonia washing. About 18 months ago I saw an illustration of it in the *Journal fuer Gasbeleuchtung*, and as we were then having trouble from tar in our water gas, it occurred to me to be just the thing to remedy the difficulty. It has acted perfectly. Since we began using that scrubber we have never had an increase of one-tenth pressure in our condenser. It not only takes out all the lampblack, but also any heavy tar that is formed.

Mr. Chollar—I make no claim for the invention.

Mr. Jenkins—I can vouch for the fact that Mr. Chollar has used it for seven years, because when I called on him in 1881 he showed me the box which he was putting in at that time.

Mr. Dunlap—How many square feet of space per thousand feet is required for the gas which is passed?

Mr. Chollar—My rule is this: If the area of the pipe is 7½, then I make it 6 feet long, so that it will approximate 1 inch in depth of water to the area of the pipe. In other words, I make it as many inches long as there are inches in the area of the pipe—taking it at the maximum of 1 inch displacement.

Mr. Odiorne—Where do you locate these boxes? Before the exhauster, or after?

Mr. Chollar—Right before the purifier, and after the condenser. I expect, if the gas is not very well condensed, there will be more or less trouble with stoppages unless you use a course screen; but if such a screen is employed the water will not stand on top. The smaller the opening the more thorough the action will be.

On motion of Mr. Jenkins, a vote of thanks was tendered to Mr. Chollar.

WELCOMING GAS COMMISSIONER BARKER.

The President—We have with us to-day Mr. Forrest E. Barker, of Worcester, Mass., a member of the Massachusetts State Gas Commission. I have the pleasure of introducing him to you.

Mr. Barker—Mr. President and Gentlemen of the Association:—I thank you for the very cordial welcome you have been pleased to extend to me as the representative of the Massachusetts Board of Gas Commissioners. I think, after the extended and very flattering notice which you, sir, saw fit to give to the report of the Board, and to the Board itself, this morning, very little remains for me to say. Moreover, I am not here for the purpose of talking, but rather of listening, in order that through your exchange of ideas I may reap the advantages peculiar to an Association and assemblage of this sort. We are laboring in a field which has very much of interest in common to consumers and companies, and which, in a certain sense, is new. We have had some indication that our work is appreciated by the public in the State where we reside, and also by the Companies under the supervision of the Board. If we have been of any benefit to the fraternity of gas engineers at large, I think we have some right to feel gratified; and the gentlemen of this Association who have been so much interested in the question of gas commissions may feel that after all their labor has not been entirely in vain. I thank you for the very cordial welcome you have been pleased to give me. It is a type of that with which I have been frequently met as I have been about the country, calling upon one and another of the gas engineers at their homes, for the purpose of learning what I could, so that our operations might be guided with all fairness and with some degree of technical accuracy. As you all know, our Board originally came to the study of the gas industry with but slight knowledge of the subject. I will not take any more of your time, Mr. President, but shall listen with pleasure to the proceedings of the Convention. (Applause.)

Mr. John Gimper, of Leavenworth, Kansas, read the following paper on—

THE CLAUS PROCESS OF PURIFICATION IN CLOSED VESSELS.

The impurities in coal gas are ammonia, sulphuretted hydrogen, carbonic acid and cyanides, which, in the Claus process, are removed by means of the ammonia contained in the crude gas, in closed vessels, at the gas works in Windsor street, Birmingham, England. The process is composed of the following different divisions:

I.—Scrubbers, Nos. 1, 2, 3, 4 and 5.

II.—Apparatus for recovering the ammonia.

III.—Apparatus for making sulphate, or concentrated carbonate of ammonia; also, of making the bye-products, such as sulphur and cyanide combinations.

IV.—In addition to the above a number of pumps to keep the ammoniacal liquor in circulation.

V.—Steamboiler for heating liquors.

The process is as follows—See Fig. 1.

In this manner of purification it is of great importance that the crude gas be freed from all the tar possible by any desired method. The gas then enters scrubber No. 1, and passes on through a series of 5 scrubbers, as shown in sketch, until, at the outlet of scrubber No. 5, it is free from carbonic acid, sulphuretted hydrogen and ammonia. At the upper end of scrubber No. 2 a continuous current of free ammonia gas is admitted, which mixes itself with the crude gas and passes on to scrubber No. 3. This free ammonia gas comes from the ammonia cooling apparatus No. 9, and is produced in the following manner.

For the washing of the gas for each ton of coal carbonized 50 gallons of water is used, and is circulated with pumps from one scrubber to another, commencing with clean water at scrubber No. 5, and ending with concentrated gas liquor at No. 1, and going in the opposite direction to the gas. In scrubber No. 1 nearly all of the carbonic acid of the crude gas is absorbed; and in No. 2 the last traces of it disappear; in No. 2 the greater portion of sulphuretted hydrogen is taken out; and in No. 3

the last traces of sulphuretted hydrogen are removed; but the gas still contains considerable free ammonia. At the outlet of scrubber No. 5 the gas is free from ammonia.

For the purification of 1000 cubic meters (35,000 cu. ft.) of gas, about 50 kilos of dry ammonia is needed, hence on a make per hour of 1,000 cubic meters, 1,000 kilos ammoniacal liquor of 5 per cent strength must be presented to the crude gas. The constant working of the pumps delivers to each scrubber this amount of liquid, and if the make of gas is increased or decreased, as the case may be, so is the water regulated at the last scrubber, No. 5.

The gas liquor at the foot of the fourth (No. 2) scrubber contains sulphide and carbonate of ammonium, and some free ammonium. This liquid, when brought in contact with crude gas in the last scrubber (No. 1) takes up nearly all the carbonic acid, because it contains free ammonia, and reaches the bottom of the scrubber as strong gas liquor, and is from there pumped to the apparatus for the recovery of the ammonia, sulphur, etc., in the following manner.

The liquor is pumped to the sulphide of ammonia decomposing apparatus (No. 6), a cylinder of about one-quarter the size of the scrubber, in which the liquor is divided as in ordinary scrubbers. From there it reaches the heater (No. 7) which contains shallow vessels heated by steam jackets, the liquid going from the upper down to the lower vessels by its own gravity—the gas liquor becoming heated in the last vessel from 80° to 90° C. In this manner the carbonate of ammonia is broken up and the carbonic acid escapes up through cylinder 6. A small portion of the ammonia is carried with it, but is taken up again by the colder liquid which is trickling down in No. 6. The carbonic acid set free in No. 7 meets the sulphide of ammonia combinations and forms carbonate of ammonia and sulphuretted hydrogen in No. 6, which reaches No. 7 again, where the carbonic acid is once more liberated, and in this manner the process goes continually on. The liquid which reaches the bottom of No. 7 contains about seven-eighths of all the ammonia as aqua ammonia, the balance being carbonate. This is now pumped to the ammonia distillation apparatus, No. 8—a cylinder constructed like No. 6, and in which a direct jet of steam meets the liquid trickling down and drives all the ammonia off in a volatile state.

It will be noticed that in the previous apparatus sulphuretted hydrogen and carbonic acid were separated from the ammonia, but in this the ammonia is separated from the liquid. The ammonia gas is now passed to a cooling apparatus, No. 9, and any ammonia water forming here is brought back to No. 8, and the ammonia recovered. The free ammonia gas coming from the cooling apparatus, No. 9, is now used again for the purification of the crude gas, by allowing it to enter scrubber No. 2.

The water reaching cylinder No. 8 contains cyanides of ammonium, but in too small a per cent. to be worked up for the cyanides; hence, it is carried by a pump through cooler No. 10 and back to scrubber No. 5, to be circulated again until of sufficient strength.

From the heater, No. 7, but little vapors of water escape, because the temperature is kept below the boiling point, but in the lower part of No. 6 are ammonia vapors and carbonic acid gas in a state of disassociation. If we now have enough ammonia in all our apparatus for the purification of crude gas made in a given time, and an additional quantity of ammonia is eliminated, then we can take off that additional part and condense it in 8, or absorb it as sulphate of ammonia.

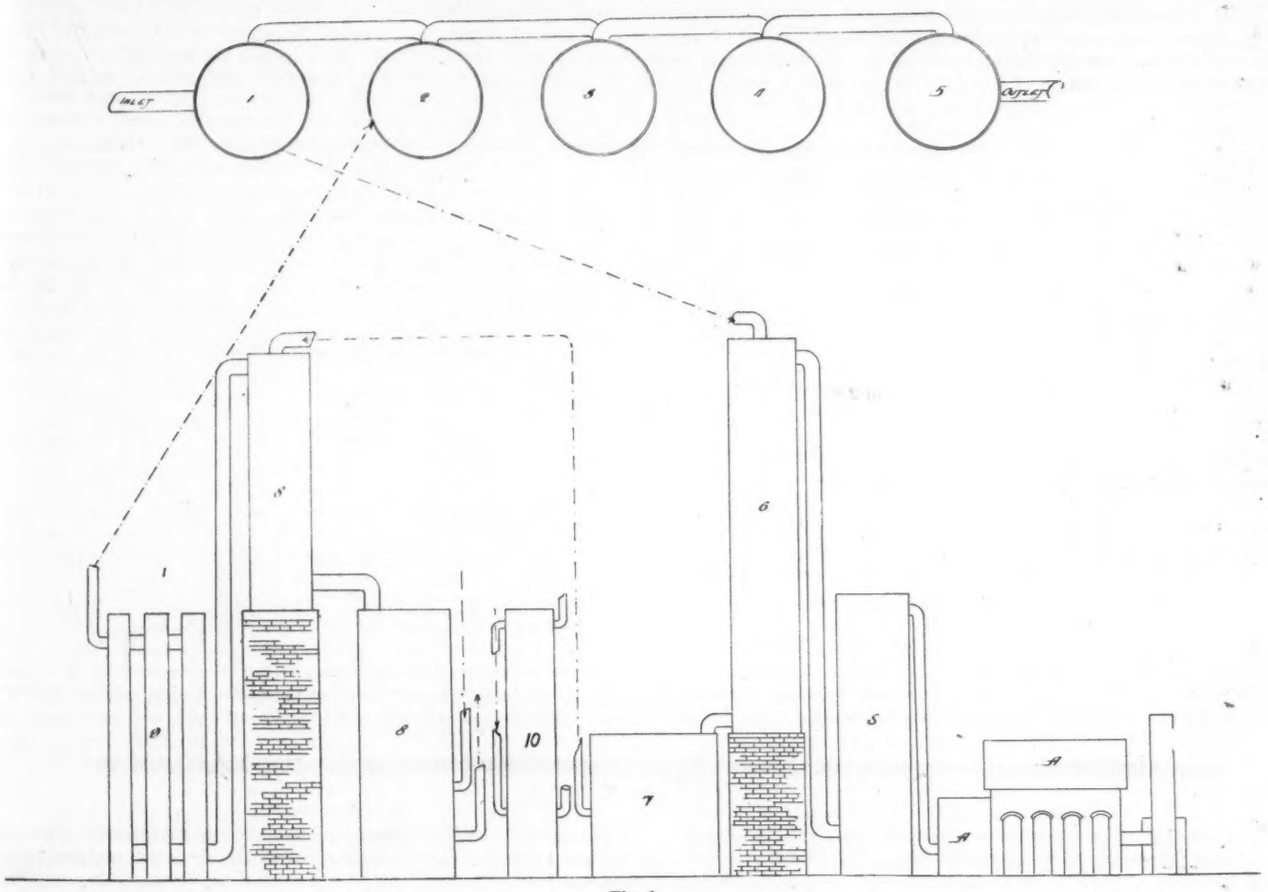


Fig. 1.

We have seen in a former part of the process, that sulphuretted hydrogen has been liberated in cylinder No. 6, from which it passes through a pipe to the sulphur recovery apparatus, A, A¹. In A¹ enough air is admitted so that its oxygen is in equivalent to the hydrogen contained in the sulphuretted hydrogen. The proper regulation of this air is said to be easily acquired by any workman. The process is now as follows: The mixture of air, sulphuretted hydrogen, and carbonic acid enters under a grate, upon which is a layer of fire brick material, and upon this a thick layer of oxide of iron, in pieces as large as walnuts. The fire brick and oxide must be heated to from 400° to 500° C.; but if hydrate is used the red heat will soon be reached by chemical action. The sulphuretted hydrogen is, therefore, broken up and free sulphur and water are formed. The sulphur is collected in the chambers, in A. In the chambers

nearest to A^1, the sulphur is in fused form, further on as flower sulphur, and in the last chamber, in a damp mass, from the water formed by the decomposition. Experience has shown that 90 to 95 per cent. of the sulphur has been recovered, chemically pure, or, if at all contaminated, it is by fine carbon.

Having finished reading his paper, Mr. Gimper exhibited a tracing of the "Gimper Atomizing Circulating Scrubber" (see Fig. 2), which he thus explained:

In this scrubber, the water or gas liquor is subdivided into a fine spray and mist by a jet of compressed gas. Said jet being located in the bottom of the scrubber, the spray is forced in an upward direction against the flow of the gas, and falling back again, thus passes twice through the scrubber. The gas enters the scrubber at the top and passes downward, thence over ziz-zag shelving, depriving the gas of its moisture again, after which it enters the next section, to be met by the next spray of weaker liquor, and so on until it reaches the last section of pure water. It will be noticed that the gas travels from left to right, and the water or liquor from right to left, being led by sealed overflow pipes from one section to the other by its own gravity, and is, in turn, taken up and atomized by its corresponding jet, until it reaches the bottom of the last section as strong liquor. Now, by adding a current of free ammonia gas to the second left hand section of the scrubber, we have a sample of the

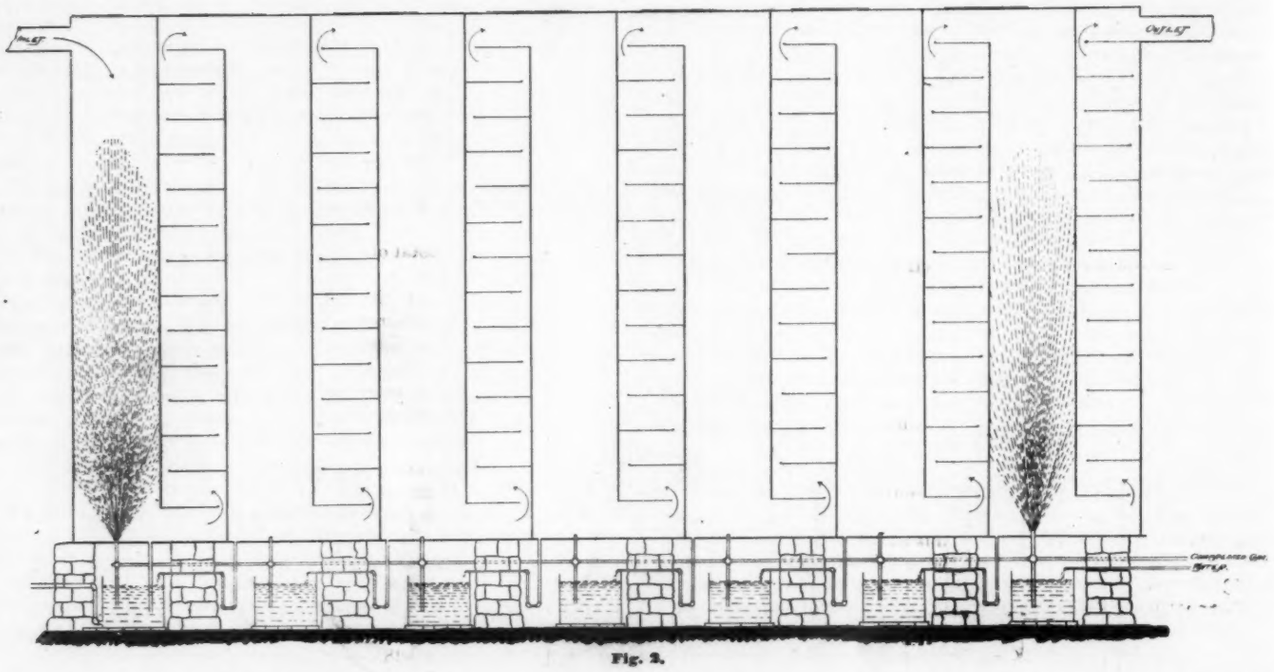


Fig. 2.

Claus system of purification, which was invented 10 years ago.

About 15 years ago, when studying up the purification of gas, and giving much thought to it, I then expected to accomplish this by the sodium combination. Not being able to carry out that plan, I fell back on ammonia, and studied out an apparatus for the recovery of the latter in connection with the one shown. I was then in correspondence with Mr. J. R. Smedberg (who was in San Francisco at the time), and on July 26, 1873, I received from him the following letter:

"The true theory is to cool your gas completely before scrubbing or washing. Scrubbing is done with gas liquor and improves the candle power. Washing is done with pure water, and ruins it. We are getting 10 to 31 gallons of 21-ounce liquor per ton by circulating scrubbing—the gas holding only 7½ grains of free ammonia as it goes to the consumers' meters. Three scrubbers with the Livesey filling, Mann distributing disc and revolving feed, cost next to nothing and will enable any company to work its liquor up to 30-ounce if it desires. The method of making sulphate to which you allude is 25 years old. We have used it 3 years, with the addition of a very important step in the process, which I will explain in full next October. Gas liquor is nothing but a solution of alkaline sulphides and carbonates and is the very best and most natural material for purifying gas. 'It beats lime or any agent in the range of chemistry' (Laming), and the clumsy and obstructive lime boxes will infallibly be superseded before long by the elegant method of liquor purification."

There is a prophecy made 15 years before a similar one made by Mr. Page, that the lime process "Will infallibly be superseded by the elegant method of liquor purification." Again, on August 18th, 1873, Mr. Smedberg wrote me, in reply to another letter, in which I stated that the action of the gas was the acid excess in the gas, and that the free alkali would be necessary to make perfect purification. He replied in this way:

"You are quite right as to the acid excess of crude gas. This is neutralized (according to a patent dated about 1820, and since forgotten) by dosing the gas at the condenser inlet with free ammoniacal gas, and then removing the sulphuretted hydrogen, bisulphide of carbon, and the sulphides and carbonates of ammonium altogether, by judicious scrubbing. Enough free ammonia must be injected to make the gas sensibly alkaline; liquor purification does the rest."

I am sorry I have not the letters which I wrote to Mr. Smedberg. I asked him for them, and he said that, although he had them, he could not find them. The outcome of this correspondence has been a scrubber like this shown in the diagram. About a year before the time spoken of, Mr. Chollar got a patent for atomizing liquids for the purification of gas; and I borrowed his patent for the scrubber. This scrubber is fifteen years old—on paper—but it is not in existence. I have here an original blue print of the drawing which accompanied Mr. Chollar's application for a patent—Mr. Chollar applied for and got a patent; hence, if we use it we will have to pay him a royalty. That scrubber can be added to any gas work, not by using the Claus process, but by adding free ammonia to *this*, and you then have exactly the Claus scrubber—only as we use it with compressed gas, we do not employ so many scrubbers. We have only the one. The accumulator, where we pump the gas, and the pressure gauge will show how much gas we have; and according to the pressure that we carry in there, so will be the amount which we pass through these scrubbers—in just the same proportion. Therefore, a man would only have to attach his accumulator and carbonize so many pounds of coal per day.

Mr. Chollar—I will also donate the patent which Mr. Gimper speaks of. It has a year yet to run.

On motion of Mr. Chollar a vote of thanks was passed to Mr. Gimper.

Mr. C. M. Keller, of Columbus, Ind., read his paper on the

COST OF ELECTRIC (ARC) LIGHTING.

It is evident that electricity as an illuminant has entered the lighting field to stay, therefore, the cost of its production is of no small

import to those who are engaged in the manufacture of gas. In presenting this paper, it is our purpose to show from tests the cost of electric light, in order that all interested may at least be enabled to figure upon it intelligently.

The time is coming when most all street lighting in the larger as well as in the smaller cities will be done by electricity, and it can be furnished by the manufacturers of gas at less cost than by any new corporation, or by the city itself.

It would be impossible to state the cost of electric light in every locality, as the price of fuel and labor varies as much so as in the manufacture of gas, for the increased quantity made decreases the cost of manufacture. For instance, excluding material, the same amount of labor required to make 10,000 cubic feet of gas per day would as readily make 30,000 cubic feet, for like reason the same amount of labor required for a 50-light plant will maintain an 100-light plant. The nearer the machine to its maximum load, the less power is required per lamp, that is, a 50-light 2,000 candle power American machine with one light requires 20.5 horse power, the same machine with 25 lights takes 28.38 horse power, or 1.13 horse power per lamp, and with its maximum load, 50 lights, 46.36 horse power, or .925 horse power per lamp.

Many manufacturers of electrical apparatus create a wrong impression in the minds of purchasers by underestimating the amount of power required to run a dynamo, the power at the machine *only* being taken into consideration, and not the power at the engine; thus, a 50-light machine is rated from 35 to 38 horse power, whereas it requires 45 or 50 horse power.

I will state here that the Company which I represent has in operation two systems, the Thomson-Houston and the American, a fifty-light plant of each, with a separate engine for each machine.

After the establishment of a plant the most important thing to be considered is to determine upon the fuel which is the cheapest and the best adapted for the work to be accomplished. In order to ascertain this, tests were made on Oct. 19th, 20th, and 21st., with 79 lamps on duty each night, as follows:

		No. Lamps
City circuit, all night	(12 hrs.)	49
9:30 o'clock, commercial circuit	(4½ hrs.)	18
11:00 " " "	(6 hrs.)	12
		79

On the night of the 19th we consumed 6,600 lbs. of Indiana nut and slack coal, which at $1.30 per ton, was worth $4.29; on the 20th, 200 cubic feet of tan bark, at 50 cents per hundred cubic feet, and 3,200 lbs. Pittsburg lump coal (at $2.50 per ton), amounting to $5.00; on the 21st, 4,160 lbs. of Pittsburg coal (at $2.50 per ton), amounting to $5.20; from which it will be seen that Indiana nut and slack, at the prices named, is the cheapest fuel; also, that one ton of Pittsburg lump is equal to 1½ tons of Indiana nut and slack coal.

We will now proceed to itemize the actual expense incurred in an all night run (12 hours) on a 50 light Thomson-Houston machine, running 48 street lights.

4,500 lbs. Indiana nut and slack coal, at $1.30 per ton	$2 93
Engineer, one night, $50.00 per month	1 67
Trimmer, one day, $40.00 per month,	1 33
Superintendent or electrician, one day, $50.00 per month	1 66
Waste, etc., $20.00 per year	05
Water rent, $40.00 per year	11
96 pairs carbons, at $18.50 per M	1 78
1 pint cylinder oil, at 50 cents per gal.	07
1 quart engine and dynamo oil, at 60 cents pergal	13
1 day repairs on machine and lamps, including globes, at $120.40 per year	33
1 day taxes on 50-light plant assessed at $5,000, at 2¼ per cent	31
1 day interest on 50-light plant, ($10,000) at 6 per cent.	1 67
Making a total of	$12.04

or 25.08 cents per lamp for an all night run of 12 hours; but since nearly all street lighting is done by moon calendar, it is necessary to make an estimate of a six-hour run, the average time per night, viz.:

2,600 lbs. Indiana nut and slack coal, at $1.30 per ton,	$1 69
Engineer, one night, at $50.00 per month	1 67
Superintendent, or electrician, one night, $50.00 per month	1 67
Trimmer, one day, at $40.00 per month	1 33
48 pairs carbons, at $18.50 per M	89
Waste, etc., one day, at $20.00 per year	05
Water rent, one day, at $40.00 year	11
½ pint cylinder oil at 60 cents per gallon	04
1 pint engine and dynamo oil, at 50 cents per gallon	06
1 day repairs on machine and lamps, including globes, $120.40 per year	33
1 day taxes on 50-light plant assessed at $5,000, at 2¼ per cent	31
1 day interest on 50-light plant ($10,000) at 6 per cent.	1 67
Making a total of	$9 82

or 20.45 cents per lamp. Both of the above tables refer only to street lighting, and any corporation engaging in street lighting alone will find this to be the actual expense incurred for either all night or moon calendar lighting.

We will now turn our attention to commercial lighting, and for this purpose we use a 50-light American machine. Expense incurred for 48 commercial lights on a 6-hour run:

2,300 lbs. Indiana nut and slack coal, at $1.30 per ton.	$1 50
Engineer and trimmer, one night, at $50.00 per month.	1 67
Superintendent or electrician, one day, at $50.00 per month	1 67
Waste, etc., one day, at $20.00 per year	05
Water rent, " at $40.00 "	11
48 pairs carbons, at $18.50 per M	89
½ pint cylinder oil, at 60 cents per gallon.	04
1 pint engine and dynamo oil at 50 cents per gal.	06
Wheeling coal and removing ashes, at $2 per week	29
1 day repairs on machine and lamps, including globes, $63.40 per year	18
1 day taxes on 50-light plant, assessed at $5,000 at 2¼ per cent	31
1 day interest on 50-light plant ($8,000), at 6 per cent.	1 33
Making a total of	$8 10

or 16.87 cents per lamp.

We have had in our city, on an average, about 35 commercial lights, and the only difference in maintaining them and the full number (50 lights) is in the amount of fuel and the number of carbons consumed.

These estimates have been made separately, on independent 50-light plants; but combining the two as a 100-light plant, the cost of maintaining 83 lamps, on a six hour run, is:

4,500 lbs. Indiana nut and slack coal, at $1.30 per ton	$2 93
Engineer, one night, at $50 per month	1 67
Superintendent, or electrician, one night, at $50 per month	1 67
Trimmer, one day, at $40 per month	1 33
Waste, etc., one day, at $20.00 per year	05
Water rent, " " , at $40.00 "	11
Wheeling coal and removing ashes, at $2.00 per week,	29
83 pairs carbons, at $18.30 per M.	1 54
1 pint cylinder oil, at 60 cents per gal.	07
1 quart engine and dynamo oil, at 50 cents per gal.	13
1 day taxes on 100 light plant, assessed at $8,000, at 2¼ per cent	50
1 day interest on 100 light plant, ($15,000) at 6 per cent.	2 50
1 day repairs on machine and lamps, including globes, $167.95 per year	46
Making a total of	$13 25

or 15.96 cents per lamp.

The above is the cost of running 48 street lights and 35 commercial lights for the first six hours of the night, when it is necessary for us to fire two boilers, which require 1,200 lbs. of coal to raise steam, or 600 lbs. for each boiler. Now, if the commercial lights were lit in the fore part of the night, as usual, and the street lights not until 10 or 11 o'clock, then the firing of one boiler would suffice, thus saving 600 lbs. of coal in the night's run.

In all of the tests it has been shown that the amount of Indiana nut and slack coal required per horse power is 6½ lbs.—that is, after steam is raised; or with Pittsburg lump coal, one-third less, or 4.34 lbs. per horse power.

It must be borne in mind that, in the preceding tests, nothing has been allowed for depreciation on plant, burning of armatures, repairs on boilers, or accidents of any kind. You will also observe that

commercial lighting is more profitable than street lighting, because it requires less labor—the engineer of a 50-light plant performing the duties of a trimmer; also, that the circuit being shorter there is consequently less resistance and need of attention.

In reference to the two systems (the Thomson-Houston and the American) no difference in the quantity, quality or steadiness of the light can be detected, as each carries a current of 9.6 amperes; but in regard to the cost of maintaining, there is a vast amount of difference, which difference is in favor of the American. We have operated the Thomson-Houston system during 15 months, or to April 1, 1888, and the repairs on same (for 48 lamps and machinery) during this time aggregated $150.50; or, for the expense so incurred in 12 months ($120.40), an average of $2.51 per lamp. During this time 3 lamps were broken through accident, the repairs to which footed up $21.46, or causing an additional expense of 44¼ cents per lamp.

We have operated the American system for one year up to April 1st, 1888, and the repairs on same (with an average of 35 lamps) cost us in the aggregate $47.55; or, $1.36 per lamp. This shows a difference of $1.15 per lamp between the two systems and in favor of the American.

We have tested both systems in an impartial manner by exchanging circuits, that is, by throwing the Thomson-Houston machine on the American circuit, and the American machine on the Thomson-Houston, the trials being made with 50 and 25 lamps. In every instance we find the American system requires less power, is less expensive in the way of repairs, etc., requires less attention, and these, we think, are the most important points to be considered.

A gas company can operate a gas and electric plant combined, advantageously; as in most cases this plan requires no purchase of real estate, no additional office rent or clerical force; the salary of the superintendent for the two combined is less than if operated separately; all steam-fitting and pipe-work can be done at cost; the coke breeze and waste fuel from the gas works can be utilized in the electric plant, and the consumer can be furnished with either gas or electricity, thus avoiding the necessity of fighting opposing companies with low-priced gas.

Discussion.

Mr. Egner—I would like to ask Mr. Keller which of those two systems gives the most light—the American or the Thomson-Houston?

The President—I believe he said there was no difference.

Mr. Spencer—Is not any discussion of the relative merits of two systems of gas lighting, electrical lighting or anything else, out of order, according to the rules which govern this Association?

The President—I am not aware of any rule of that kind in the by-laws. It is for the Association to determine. If they prefer not to discuss the merits of the machines, or compare one with another, we can pass a rule to that effect.

Mr. Spencer—I do not know whether we have such a rule, but I think in former meetings, a very general opinion prevailed as to the impropriety of allowing the relative merits of machinery of any kind to be discussed or commented upon in our conventions.

The President—I do not know of any. The gentlemen who present papers will have to determine that matter for themselves.

Mr. Jenkins—Many of us interested in this subject would like to know which is the best apparatus, and we cannot learn in any better way than by asking the question here. I do not think it out of the way to do so. I would like to ask Mr. Keller with regard to the difference in the repair expense item of the two machines. I understand the Thomson-Houston light lasts about three times as long as the other.

Mr. Keller—It averages about 6 hours. We run ordinarily until 11 o'clock at night; on Saturday until 12 o'clock.

Mr. George McMillan—Can Mr. Keller tell us how many carbons a ton of coal will convert into light? Of course, the expense for labor and repairs will be governed by particular cases; but we can all get at the cost of the carbons by figuring what the price of coal will be.

Mr. Keller—I never made such a test, for the reason that it is a hard matter to keep account of. If we are running commercial lamps, with a 50-light machine, the carbons will last about 7 hours.

Mr. Dunbar—We operate an American plant at New Albany, Ind., and it takes 5 lbs. of fuel per hour for each 2,000 candle power lamp, and in each lamp the upper carbon will burn about an inch, while the lower carbon is burning one-half inch. From this data, perhaps, the gentlemen can arrive at a conclusion.

The President—How many inches can you burn before the carbon is destroyed?

Mr. Dunbar—In the upper, 10 inches; in the lower, about 5 inches.

Mr. Howard—I think the point raised by Mr. Spencer, with regard to discussing the relative merits of electric light machines, is a good one. We might, if we carry it further, discuss the merits of different meters or gas stoves, with the result of bringing about a dispute among the representatives of the different manufacturers or users of these articles represented in the convention. Certainly the same rule should apply to any other machine or apparatus brought before us for discussion. I think it is out of order to make comparisons of this nature.

Mr. Scofield—I do not care greatly about the relative merits of the systems. If it costs but 16 cents to furnish an arc light for which 50 cents per night is received in payment, then it seems to me that gas men have either to retire, or get into the fuel business, or something else. If I understand Mr. Keller, he said the average was about 16 cents for commercial lamps, running six hours. What do you get for the light?

Mr. Keller—Six dollars per month.

Mr. Scofield—But you do not figure the wear and tear at all. This is what we must get at in order to arrive at a proper conclusion. What I want to learn is whether gas men can afford to invest any little surplus they may have in an electric light plant in order to maintain their gas works, and I am considerably interested in the matter. If the profit is but 3 or 4 cents per night, without any allowance for wear and tear, Mr. Keller's people are not making very much money on the business. Gas gives a much better percentage return. We are harrassed at Fort Scott, Kansas, on every side and every day with arguments from electric light companies. We do not ignore the electric light and do not expect to, because we expect to meet it in competition. What I want to know is whether I must put in an electric light plant in order to maintain my gas interest, and whether I must run that electric light plant at the expense of my gas interest. Wichita, Kansas, possesses two electric light plants, one of which (the smaller of the two) is operated by the Gas Company. Last year the latter ran behind something over $2,000. The price of lights was put down at a low figure—I think not over $6 per month; perhaps as low as $4 at one time. Although this plant fell behind over $2,000 the deficit was made up out of the profits on the sale of gas. The independent electric company, it is said, fell behind somewhere between $5,000 and $6,000.

The President—How did *they* make it up?

Mr. Scofield—I have not ascertained yet. It is the combined electric light and gas business that gas men are most anxious to know about. I want to know if I have to put in an electric light plant in order to save myself from bankruptcy—we do not often hear of gas companies going into bankruptcy; but we do occasionally hear that electric light companies go into the hands of receivers. An electric arc light company came into a city with a great spread; and they did spread out 25 lights over the city for 12 months, on a contract—I refer to a small town on the western borders. We were lighting 58 street lights prior to the advent of the electric light company, and the loss of the corporation business nearly ruined us. However, at the end of the first year the electric light plant stood idle, while we have to-day about 260 gas lamps which are making a fair return on our investment in them. In order to do this we put in about 10 miles of piping last season, at a cost of $25,000, rather than put it into an electric light plant. We have that investment there, and we have also used up all the money we had to spare. Now the question is whether we can afford to run in debt to put in the American, the Thomson-Houston, or any other system of electric lighting in order to maintain our interests. I want to learn all the facts. If we have to surrender, and go into the electric lighting business, I desire to know it. I do not care anything about the system—let us learn that for ourselves; and I do not believe in discussing the merits of different systems here, because that is not what we came here for. We are not here to advertise any particular system. We have been trying to meet the schemers who are trying to beat us. We are, in heading off the electric light, simply trying to maintain our own and avoid being snowed under. We put in the McKay-Critchlow process to manufacture illuminating gas out of the natural product which is found in our neighborhood. We put in 2½ miles of pipe line to convey the gas to our works—we were stopped by the City Council for 24 hours, but finally succeeded in obtaining the gas. To head off that, the electric light company got an illuminating and fuel gas

franchise, and now they propose to light and heat the city. We are contending with all these interests. We made a success of illuminating gas made from the natural product, enriched with Lima crude oil. It is rather nasty stuff, but it gives a 22-candle gas.

The President—Which is the better, the Critchlow or the Lowe process?

Mr. Scofield—I do not know anything about that.

Mr. Ambrose—I am differently situated at Springfield, Mo., from my friend at Fort Scott. I think the gas men simply want to keep on top. I look at it a good deal as a matter of wrestling. It does not make any difference whether you throw the man or not, so long as you keep on top. For some time I was running a gas plant in peace, when along came the electricians, and we fought them bitterly; but, finally, we thought we would get on top. For the last 12 months I have been keeping the books and handling the finances of the two companies—one is a Thomson-Houston Electric Light Company, and the other is the Gas Company, run on the good old system of making coal gas. I handle the money of one company carefully with my left hand, and that of the other with my right hand. Keeping as I do the books of both companies, I am prepared to say how the two companies are paying, and what they are doing. Since I took charge of them, the Gas Company has managed to get on top, and there it is going to stay. Since I took charge of the two companies my books show that the gas business, instead of being put down, has increased 20 per cent., and not from any unnatural cause. We have not made one foot of main extension, and have not increased our plant at all; we are simply on the same line that we were before. The electric light business has not increased quite so much, but it is doing very well. I am prepared to say that on a capital stock of $162,000, for both companies, we will pay over ten per cent., besides taxes, wear and tear, and everything else. I think that answers the question of Mr. Scofield. ...se both of them, providing you can use them profitably. I am ...ing to use them profitably, and I will show the stockholders I can ... 10 per cent. out of both; perhaps something more. If we can ... the electric light successfully in co-operation with gas, and ... other people out, it is best to do it; if we cannot, then give it ... I say we can do it. I am interested in another little place in which we put in an electric light plant. They fought us for a while, but the result was that in the last three months the Gas Company managed to secure a top hold, and is running that electric light plant. In the last instance we have two systems of electric lighting, and we have also our gas plant. In that case the Gas Company gobbled up the electric light, although the electric light people originally proposed to gobble us. The fact is they were strangers, and we just took them in—that is, they were strangers to the manner of manipulating the business so as to make it pay properly. We expect to make it profitable—I say we expect to; but I know we will, for I generally make a profit out of anything that I take hold of, or else I shake it off. I started the Fort Scott works before Mr. Scofield secured them.

The President—And you shook them off?

Mr. Ambrose—Yes.

Mr. Scofield—I thought so.

Mr. Ambrose—There is a good deal of cream there yet, for I left the cow behind. We only took a good portion of the milk, and cream, and butter. We are fully determined that an electric light company shall not take our profits when we can just as well do the business ourselves. I think a gas company can run an electric light plant much more economically than it can be done by any set of independent operators. The only question is whether we can run it profitably or not. Those who do not think so should visit Springfield, Mo. Come there and I will show you my books. I keep nothing secret—save the money when the tax man comes around. I am Secretary and Manager of the Gas Company, and I am Secretary and General Manager of the Electric Light Company. We have two separate companies, with separate buildings; but we utilize our profits, and I ride the same pony in going the rounds.

Mr. Scofield—What I would like to know is whether as gas men we can afford to butt against the electric light, rather than invest our capital in an electric light plant. Our people are about establishing an incandescent plant. Can we, as Mr. Ambrose says, afford to gobble it up; or shall we fight? I had made up my mind to put gas down to $1.50 per thousand, and to permit the electric light folks to come in. If they, under the circustances, can make a bigger dividend than I do, let them try it.

Mr. Clark—Did I understand Mr. Ambrose to say he made ten per cent. on the investment in the gas and electric light plants?

Mr. Ambrose—Yes.

Mr. Clark—Has he estimated what the profits would be if he had no electric light plant?

Mr. Ambrose—Our people did not seem to greatly want any light until they found out there was another light than that from gas. In fact we had a hard time to make a living before the electric light folks came in.

Mr. Scofield—We now have 260 lamps inside and outside of the city limits, and our gas output has more than doubled since the electricians first visited us.

The President—I trust Mr. Spencer will excuse me for allowing the discussion to go on after he raised his point of order; but the gentlemen who spoke subsequently did not touch upon the point he raised.

Mr. Spencer—The discussion has had no relation to the point of order raised.

The President—The facts and figures presented by the gentleman in his paper were eminently proper, in the absence of any rule to the contrary. If you want to establish a rule limiting discussions, a motion to that effect will be in order.

Mr. Bolcom—This is a very interesting subject to me, and I would like to hear from Mr. McMillan, of LaCrosse, Wis., who has gone into the electric light business—I have not done so yet; and I am seeking information. He may give us a practical illustration of how our Gas Companies may take hold of this branch of lighting supply.

Mr. George McMillan—The history of the electric lighting business at our place is something like this.

In 1882 an arc plant was started in our city, and after two years, unlike the experience at Springfield, the Electric Light Company got on top, and bought out the Gas Company, although the latter is nominally still running as a separate organization. In fact they are each being run to-day as two separate organizations, each having its own Board of Directors and staff of officers. I act as Secretary and General Manager of those companies. We run them in that way, and have secured the street lighting for a term of five years, from the beginning of 1885. The business was run very satisfactorily in the interest of both companies. I was perfectly indifferent as to which kind of light was preferred, electricity or gas. The consumers made their choice. About a year ago the Edison folks organized a new company, in which they enlisted 45 or 50 of our prominent citizens. These gentlemen having great influence in our city, their company made decided inroads on our business, having taken away a number of our consumers. We expect to get a good many of them back—and some we have back now, and we expect to get others to return. I think our mistake was that we did not start an incandescent light company of our own. Had we done so I do not think they would have come in at all. We waited too long. So far as the arc light lamp is concerned, it pays very well, and we have no reason to complain at all. If we used it simply as a street lighting circuit, the number of lights we have would not be sufficient to make it pay; but, taking account of the commercial lights in connection with the public lights, the business, as a whole, is profitable.

Mr. Scofield—Is the incandescent light giving perfect satisfaction to the consumers?

Mr. McMillan—In some cases, yes; but not everywhere. Some people prefer the incandescent light, irrespective of its cost, and it is well for us to recognize the fact that certain people (a class to be found in almost every community) are willing to pay more for the incandescent light than for the same amount of light from gas. The incandescent light has some direct advantages, but I do not think it is of such universal application as gas. I have noticed in almost every store where it has been used that two or three times as many lights were burning as when gas was used.

Mr. Scofield—Will Mr. Chollar state his experience in Topeka, Kan., with the incandescent light?

Mr. Chollar—Topeka is said to have one of the finest Edison plants in the western country. I understood that at one time they had about 5,000 lights. They got at first a great many of our customers, but many of these came back to us again; probably we will never get them all to return. Our business, however, has not suffered very seriously. We sent out probably 20 per cent. more gas last year than we did the year before. Probably the lighting business is much larger than either Company could do alone; and I doubt if our business is very much smaller, if any, than it would have been without the electric light company. My

idea is that people take the incandescent light because they like it, and not because its price is lower, and those who do take it use just about as much gas as they did before.

Mr. Scofield—Are you getting any of the incandescent consumers back again?

Mr. Chollar—Plenty of them; 5 or 6 a day; they are becoming dissatisfied.

Mr. Jenkins—You may remember that at our St. Louis meeting last year I stated this matter of electric lighting was the principal object of my visit to the convention. On my return from the meeting I investigated two or three different plants, and when I went back to my home at Columbus, Ga., I was prepared to make some sort of report on the matter to our Board of Directors. It looked for a while as if the local electric light companies in Columbus were preparing to take our entire business away from us, and, naturally, we were somewhat worked up over it. Our board had about decided to put in a first-class electric light plant. About that time one of our largest stockholders (he is a member of this Association) presented the subject in this way; said he, "We have a company in our town now supplying electric light and the Gas Company proposes to supply that light also. How are we going to do it? Will not your proposed plan induce a great competition? If so, where, then, will your poor little Gas Company be? Two electric light companies will, in competing for the business, be simply cutting down prices, and the Gas Company will undoubtedly be the greater sufferer in the conflict." The question was so pertinently and strongly put that we have not put in the electric light plant, and I do not think we will just yet, although the local electric light company has taken a part of our street lighting from us. By way of answering the question, as to what the effect upon us has been, I may say that taking the first 4 months of 1888 as compared with the first 4 months of 1887, we are sending out 16 per cent. more gas than last year. Both incandescent and arc lights are supplied; but I think our town is too small to support two electric light companies and one Gas Company.

Mr. King—You will perhaps remember that at the end our long discussion at St. Louis on this subject, Mr. Jenkins said: "I have been converted," I fear, however, that he has "back slid." Mr. Scofield will remember that, when he visited me two years ago we had gone into the electric light business experimentally; and without any very great confidence in it ourselves. We packed the electric light plant away in the back part of our coal shed—for it was intended only as an experiment. We are now engaged in erecting a large building for it with the intention of making everything permanent. We have lately ordered an increase in our plant. I think our action after two or three years' experience should be an indication of how we feel with regard to the electric light.

Mr. Scofield—Have you anything but the arc light?

Mr. King—We shall probably put in the incandescent this summer.

Mr. Steinwedell—We have been in the electric lighting business at Quincy, Ills., since October 1st, when we bought out an entire plant of 310 lights. We considered it then to our interest to do so, and we to-day consider that it was the best thing we ever did. I differ with the gentleman as to the cost—I cannot give any exact statement of the cost of maintaining the lamps, but they cost us more than the figure named by Mr. Keller. I have the gross amount, and a general idea of the items which go to make it up, but have not had time to figure it out. I will promise, however, to figure the thing out accurately at the end of the twelve months, so that before our next meeting I will be able to speak by the book. We do not operate the plant right on our own ground—we had to buy the plant out; taking it as we found it, it may be a little more expensive to operate because of being separated from our gas works. We have large circuits, having to run about 35 blocks one way, and from 24 to 30 blocks the other. We have a circuit of 10, 15, or 20 miles, and our wires alone extend over 60 miles. All this has to be taken into consideration. Perhaps the gentleman does not figure in the wear and tear and interest on capital.

Mr. Keller—I figured 6 per cent. on capital.

Mr. Steinwedell—I do not think the electric light can be furnished as cheaply as has been stated; and it is my opinion that we should all be careful to make no mistakes in our statements as to cost.

Mr. King—Of course, the larger the city the less it will cost.

Mr. Steinwedell—If we had to do this thing over again we might take a different plan to head off competition. There will be war between gas companies and electric light companies, and if you do not buy them out they will bother you considerably. I do not believe it is proper to make our estimates so very low on the electric light; because in that event we are simply fighting ourselves. I am convinced it will be better for gas companies to consolidate—either to establish a separate electric plant or buy out those already in the field.

On motion of Mr. Ramsdell, a vote of thanks was rendered to Mr. Keller.

Proposing to Change the Title of the Association.

A motion made by Mr. Egner, to change the title of the Association to that of *The Western Gas and Electric Light Association*, was lost.

Naming Place of Meeting.

Mr. Jenkins—The committee on selecting a place for holding the next meeting of the Association have decided to recommend Indianapolis, Ind., which city comes in the regular routine established and followed for several years. In this connection I wish to say that Mr. Jas. Sommerville extended to the Association a cordial invitation to come to Indianapolis this year.

On motion, the report was accepted, and the recommendation adopted. This terminated the sessions of the first day.

SECOND DAY.—MAY 10.—MORNING SESSION.

The Convention came to order at 10 A. M. The proceedings were initiated by the reception of the following reports:

REPORT OF COMMITTEE ON PRESIDENT'S ADDRESS.

Gentlemen: Your Committee, to whom was referred the address of the President, beg leave to submit the following report:

It would be impossible for your Committee, in the brief time at their disposal, to do full justice to this admirable address, and we can only refer to its principal features.

First—We desire to emphasize the deplorable lack of interest shown by gas company officials in not more fully and cheerfully responding to the list of inquiries sent out. Inasmuch as the statistics are for the general good and welfare of the entire light fraternity, we would like to impress upon the members of the Association the importance of co-operation in all such cases, and respectfully recommend more careful attention to such matters in the future.

Second—We desire to call especial attention to that part of the address which foreshadows an enormous increase in annual sales of gas through the adoption of the incandescent gas burner.

We urge upon every gas engineer the great importance of experiment, and the promotion of efforts to speedily reduce the theory of fuel gas to actual and successful practice.

Upon the subject of gas commissions, we heartily endorse the position taken in the address, and believe the position already taken by this Association to be correct and eminently practicable, and, with all due deference, more accurately meeting the wants of the gas fraternity than can be reached in any other way.

We also endorse and recommend the adoption of a uniform system of figuring the accounts of gas companies, more especially that division of such accounts which enters into the "Cost of gas in the holder."

As a basis of comparison, this is indispensable. We heartily endorse the remarks concerning the non-payment of dues, and submit the following amendment to Article IV. of the by-laws:

Section 2.—"No member who is in arrears for dues for the previous year shall be allowed to participate in the deliberations of the meeting.

Sec. 3.—"The Secretary shall drop from the roll the name of any member who shall be in arrears for three years' dues.

Sec. 4.—"The Board of Directors shall have power to reinstate any member who has been suspended for non-payment of dues, when such member shall have paid the full amount due at the time his name was stricken from the roll."

Amendment to Article I. of By-Laws.—Instead of "The annual meeting of the Association shall be held on the second Wednesday of May in each year," etc., to read as follows:

"The annual meeting of the Association shall be held on the third Wednesday in May of each year."

Discussion.

Mr. King—I move the report be accepted, and that the suggested amendments to the by-laws be adopted.

The President—I want to call the attention of the Association to one of the by-laws:

"Any proposition to alter or repeal any existing by-law shall be presented, in writing, on the first day of an annual meeting, seconded by not less than three members, shall lie over until the next day and be again read, and, if approved by two-thirds of all the members present, shall become a part of these by-laws; but no such alteration or amendment shall effect any question pending at the time of its adoption."

I thought yesterday that possibly the by-law suggested by me,

being the one recommended by the Committee in their report, might be adopted this morning; but that refers to the repeal or amendment of any by-law already in existence. One clause, though, seems to rule us out on this. The obstructive clause is:

"Any additional section to these by-laws not in conflict with any existing by-law may be adopted at any annual meeting, upon being presented in writing, duly seconded, read twice and approved by at least two-thirds of all the members present."

If you consider this as being read twice—once yesterday and again this morning—I will rule that it is proper to vote on the question.

A rising vote on the acceptance of the report and the adoption of its recommendations showed a unanimous agreement in both respects.

Mr. Pratt—I wish to ask a question for my own information. I have been an active member of this Association ever since the date of my admission, but I am now changing my business. Will that change of business cause me to become an associate member?

The President—No, sir.

(To be continued.)

The Combustion of Fuel in Steam Boiler and other Furnaces.

The London *Journal* recently printed the following interesting comments on the above named subject. The commenter wrote:

M. Scheurer-Kestner is one of the most skillful of modern calorimetrists; and it is not surprising to be told that he has devoted himself for the past twenty years to studying the combustion of coal. It is not too much to expect of the new series of experiments upon this subject announced by him, in which he is to make extensive trial of M. Berthelot's so-called "calorimetric bomb," that they will clear up much that is mysterious and unsatisfactory in the results of other calorimetric methods. In the meantime, some interesting statements upon the general subject of coal combustion have been put forth by M. Scheurer-Kestner, in the form of a lecture before the French Chemical Society. A special point was made in this lecture of the importance of a proper examination of chimney gases as a means of determining what goes on in the furnace. It was shown that these analyses are often conducted in a manner that seriously misleads the investigators, and that, to be reliable, great care is required to shut off all possible sources of error. Leaks of air, insufficient mixture of the gases, etc., all prejudice these examinations. By making sure of his data collected in this way, M. Scheurer-Kestner has ascertained the most favorable proportion of air for the perfect combustion of fuel. He began with too little, and tried various proportions of air up to a quantity exceeding anything that would be employed in practice. He found, for example, in this way that if only 8 or 9 cubic metres of air were supplied for the combustion of a kilogramme of Ronchamp coal, there would be found carbonic oxide, hydrogen, and marsh gas in the products of combustion, representing a loss of from 6 to 18 per cent. of the carbon of the coal. If from 10 to 12 cubic metres of air are supplied, the loss of carbon is only from 4 to 6 per cent.; with 15 cubic metres of air, the loss is reduced to 1 or 1½ per cent. M. Scheurer-Kestner insists upon the importance of making determinations of this character, in order to ascertain in every case the exact limit when the loss is most attenuated and the advantage the most considerable. Generally it seems that a theoretical surplus of 5 per cent. of air is the best in practice.

In the course of these experiments, steps were taken to ascertain the amount of carbon lost in the smoke of a factory chimney. A glass tube containing from 25 to 30 centimetres of asbestos was placed in communication with an aspirator, and with the interior of the chimney, and the volume of aspirated gas was measured. The asbestos was packed lightly, so as to permit the gas to pass freely through while retaining the soot. The latter only penetrated through 5 or 6 centimetres of the asbestos; leaving the rest perfectly clean. A means was thus provided of ascertaining the proportion between the quantity of soot produced and that of the coal consumed in the furnace. It is remarked by M. Scheurer-Kestner, as a curious and noteworthy fact, that although the smoke was often very dense and black, especially when for experimental reasons the air supply to the furnace was restricted to something less than the normal quantity, the soot of it did not represent a loss of more than 1.5 per cent. of the carbon of the coal. With a very slight increase of the in-draft of air, the loss from the smoke fell to 0.5 per cent. Consequently M. Scheurer-Kestner does not attach much importance to the production of smoke, and treats appliances for smoke prevention somewhat summarily. He only recognizes two efficient systems of this order—the one based upon mechanical feeding of the furnace, and the other upon the intimate admixture of very hot air with the products of combustion. In both cases the supplementary expenses of the apparatus exceed the economy realizable by the suppression of smoke. M. Delahaye, in repeating this assertion in the *Revue Industrielle*, points out that it is purely theoretic, and adds that there are many cases where the suppression of smoke is necessary, and consequently where smoke-preventing appliances must be patronized, whether these are theoretically economical or not. At the same time, the commentator declares that the attention of people disposed to complain of smoking factory chimneys cannot be too strongly called to M. Scheurer-Kestner's revelation of the economic undesirability of smoke-preventing apparatus. This reasoning is a little obscure; for the consideration that smoke-preventing arrangements do not pay the user is not likely to render anyone who suffers from the proximity of a smoky chimney less anxious for the abatement of the nuisance. It is, of course, advantageous that the question should be put upon its proper basis; and we have consistently opposed the claims and exposed the ignorance of our own smoke abatement enthusiasts who have told the world that smoky chimneys are necessarily attended by waste of fuel. These advocates of smoke prevention tried to make out that self-interest impels fuel-users to burn fuel smokelessly; but the more experienced fuel-users themselves know very well that smoke-prevention devices, however successful, are always costly both first and last. Our contention has been that, instead of doctoring smoky furnaces, the true interest of fuel-users points them to the employment of coke or gaseous fuel; while the public interest is best served by the rigid enforcement of smoke-prevention regulations resting not on the supposed self-interest of the fuel-user, but called for by the higher and more general necessity of aerial sanitation. The public interest warrants the community in enforcing smoke-prevention upon the factory-owner, regardless of the consideration that the reform may not be profitable to himself.

M. Scheurer-Kestner went on to deal with the economy of boiler firing. With an exterior-fired boiler of three cylinders, fitted with a re-heating arrangement, using Ronchamp coal, the following was found to be the percentage distribution of the heat power of the fuel in calories: In the steam, 63.5; carried off by the chimney, 5.1; represented by combustible gases with waste gases, 4.9; corresponding to the smoke, 3.7—total accounted for, 77.2 per cent., leaving 22.8 per cent. unaccounted for. In later experiments, 78.9 per cent. has been obtained in the steam and combustion gases from Ruche coal; and as much as 83 per cent. with an English coal of exceptional quality. The unaccounted for percentage is chiefly due to radiation.

A commentary upon these observations of M. Scheurer-Kestner is supplied by the published tests of a water-tube boiler fixed at the Sibley College of the Cornell University, in the United States. These experiments are reported upon by Mr. R. H. Thurston, who gives them in great detail. Every conceivable precaution seems to have been taken to secure reliable indications of the performance of the boiler. For analyzing the waste gases, an apparatus designed by Professor Elliott was used, consisting of a stand of tubes for testing for carbonic acid by potassic hydrate solution, and for oxygen by potassic pyrogallate. The amount of carbonic oxide not being obtained satisfactorily by cuprous chloride, although it was "evidently present," was calculated from the carbonic acid. The quality of the gases in the chimney did not vary much during the tests, and is given as having been about 12 per cent. by volume of carbonic acid, 6 per cent. of free oxygen, about 3 per cent. of carbonic oxide, and 79 per cent. of nitrogen. The two former were observed, and the two latter computed. The air supplied was after the rate of about 16 pounds per pound of carbon consumed. Reduced to proportions by weight, Mr. Thurston states the average percentage composition of the flue gases to have been: Oxygen, 7.108; carbonic acid, 17.059; carbonic oxide, 2.584, and nitrogen, 73.34. Upon this statement we may be permitted to remark that it is usually understood that the existence of free superfluous oxygen in flue gases is incompatible with the presence of carbonic oxide. Seeing that 1 lb. of carbon only requires theoretically 12.03 lbs. of air to convert it into carbonic acid, and this furnace had an excess of 50 per cent. of air, the reason for calculating on the presence of carbonic oxide in the smoke gases is not very apparent. The net result of the test was to show an evaporating duty for the boiler in question of 10.486 lbs. of water from and at 212° Fahr. per pound of fuel (anthracite). The apparent confusion between the calculations of carbonic oxide and the observed proportion of free oxygen in the furnace gases recalls M. Scheurer-Kestner's caution upon the subject of the analysis of flue gases.

In connection with the general question of the combustion of solid fuel in boiler furnaces may be mentioned the growing popularity among marine engineers of forced draught, whereby the evaporative power of boilers is materially increased, and the consumption of fuel diminished. The advantages of forced draught, like those of gaseous firing, cannot possibly be learned from the text-books. Hitherto, forced draught, which is merely that produced by a mechanically driven fan, has not been tried for any furnaces but those of steam-boilers. It becomes a question, however, whether this method of firing has advantages only for this class of furnaces. A long time ago we recommended a trial of mechanical *versus* chimney draught for the working of gas generators used for heating gas retorts; but we are unaware that anything has been done in this direction. Yet the advantages of being able to control the process of combustion, which such a device would confer, should be worth something. Whether the benefits of mechanical draught in the working of gas generators would be sufficient to compensate for the additional complication is, of course, the question. Any experiments designed to elucidate the point must involve regular and careful analysis of the contents of the exit-flues; and therefore M. Scheurer-Kestner's warning upon this head is worthy of attention. It is very certain that no tests of furnace working are deserving the name of instructive unless they are accompanied by, and rest upon exact and detailed analyses of furnace gases. Furnace practice has been put upon a fresh footing of actuality since Herr Bunte and others placed in the hands of fuel users their well-known appliances for chimney-gas analysis. It is to be regretted that these guides to good furnace working are not used so generally as they ought to be.

THE AMERICAN GAS LIGHT JOURNAL

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SATURDAY, JUNE 2, 1888.

The Market for Gas Securities.

The city market is without feature save that of complete dullness. The event of the fortnight was the declaration of the semi-annual dividend on Consolidated shares, and no little disappointment was caused over the result. The rate remains unchanged, and holders of record on date of 31st ult. will receive their dividend checks on and after the 15th inst. The stock is fairly well held, and it is possible that 80 will be again recorded in the near future. In any event, we would rather buy than sell now, provided a choice had to be made. Other city shares are somewhat weaker. Treasurer Smith, of the Spanish-American Light and Power Company, 40 and 42 Wall street, informs stockholders that a quarterly dividend of 1½ per cent. has been declared. Transfer books close on the 5th inst. Brooklyn shares show some activity and much strength. We note the following sales at auction of Brooklyn securities: 60 shares Nassau, at 103¾; $900 scrip, same Company, at 97; 48 old Brooklyn, at 103; 1 Metropolitan, at 80½; 14 Citizens, at 55¾. The Governor of Massachusetts has signed the bill granting the Bay State Gas Company the right to increase its capital stock; but we are unable at this writing to say what effect that action has exerted on Boston gas shares. Other Eastern shares are firmly held. The Montreal disaster has disturbed local gas values, but no doubt these will soon recover their normal tone.

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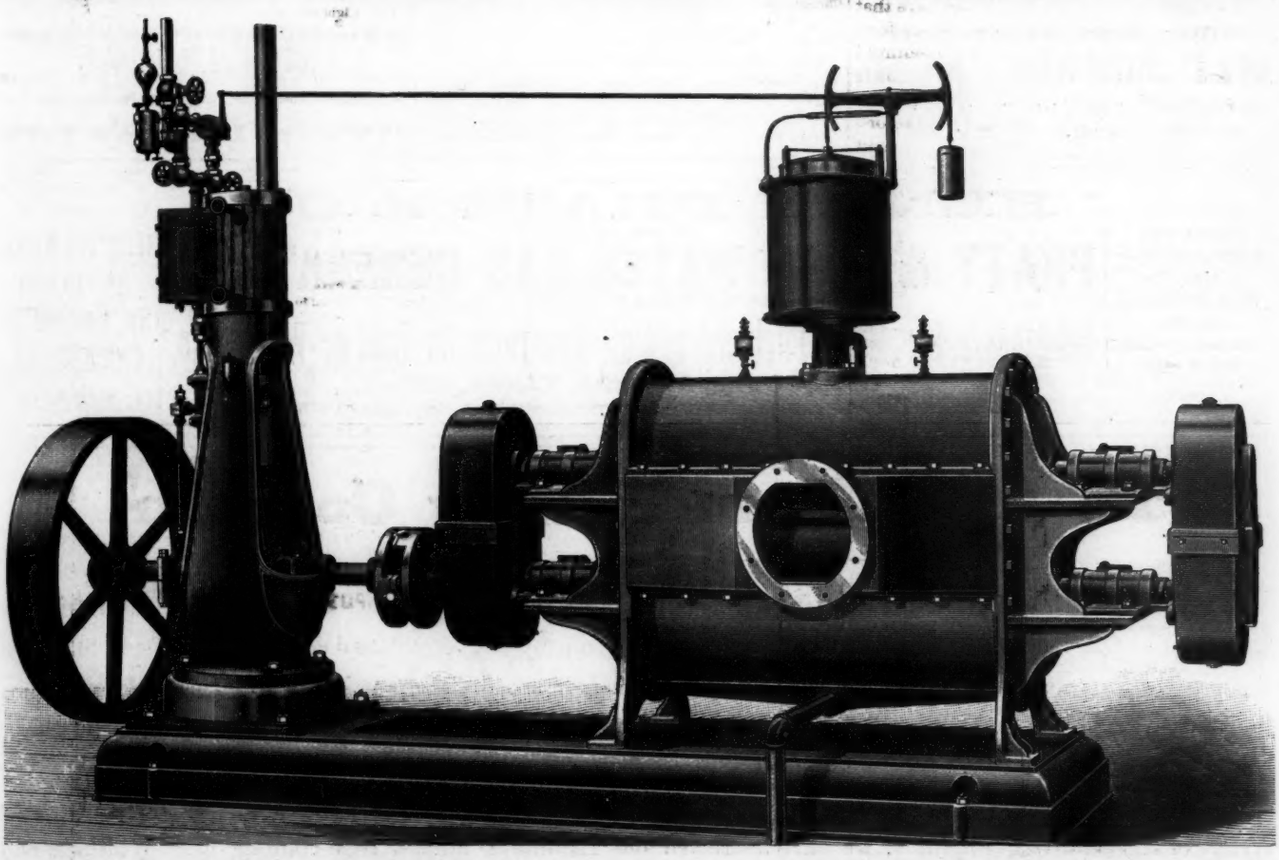
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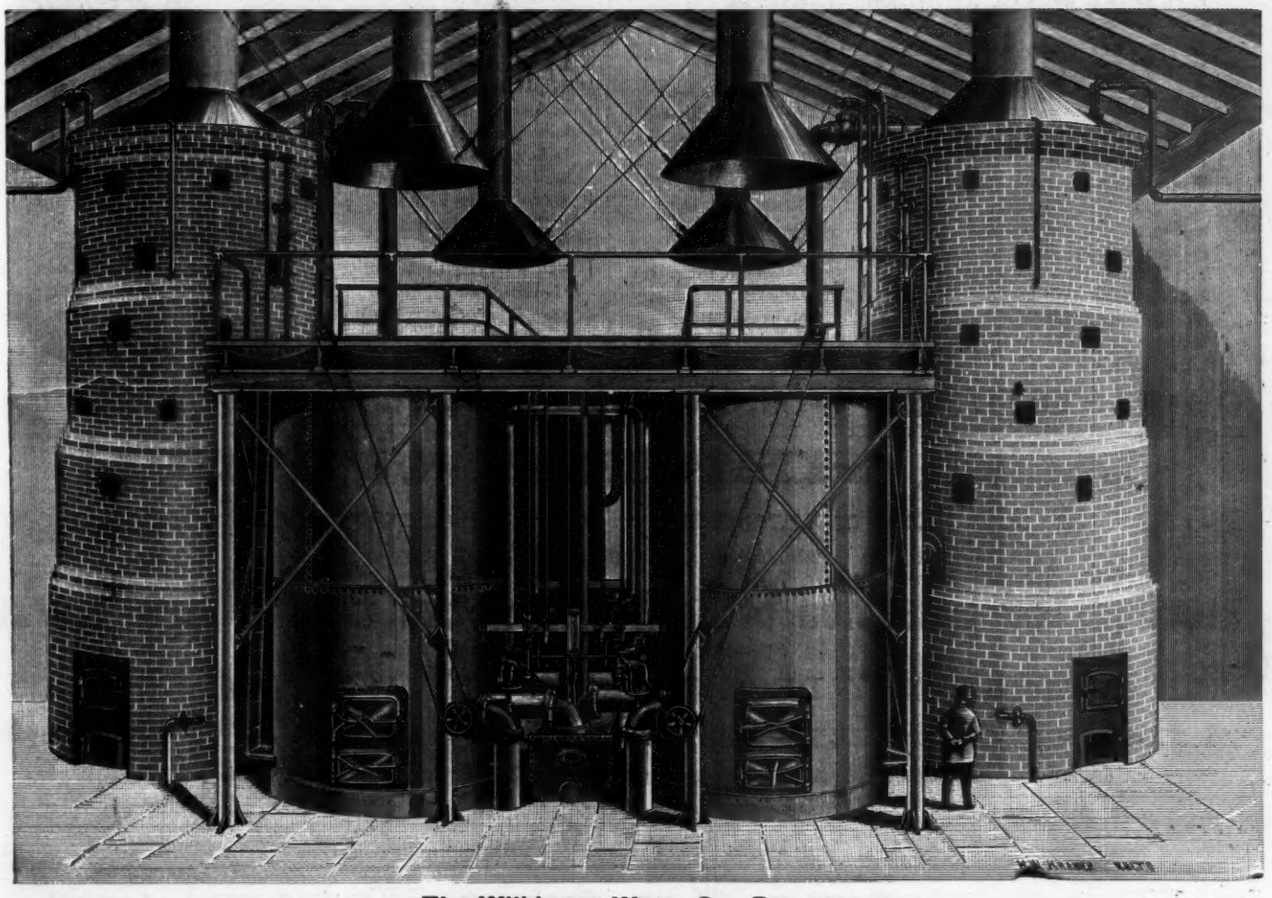

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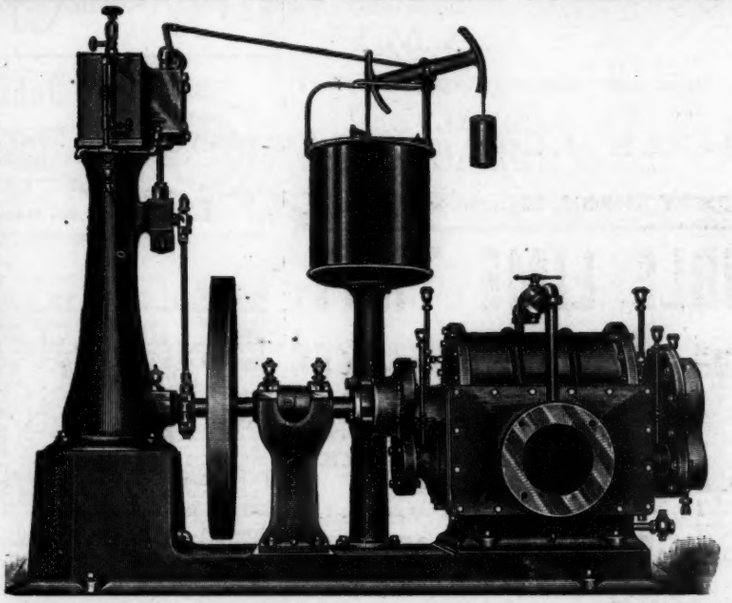

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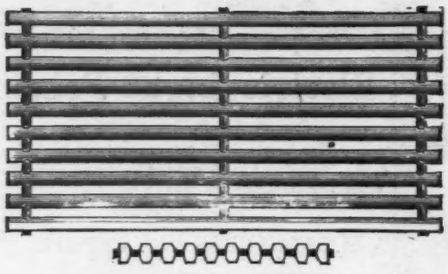

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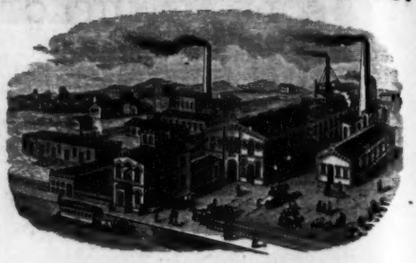

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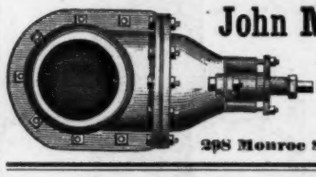

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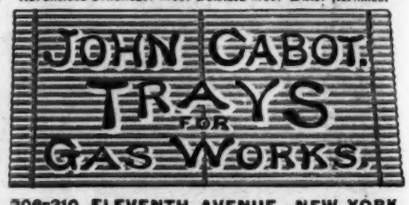

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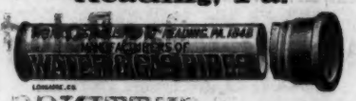

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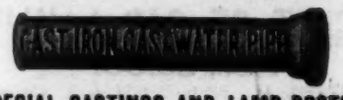

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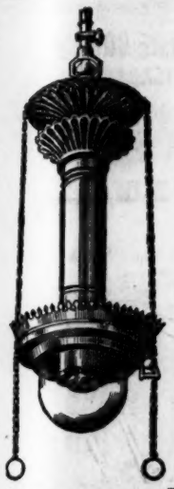

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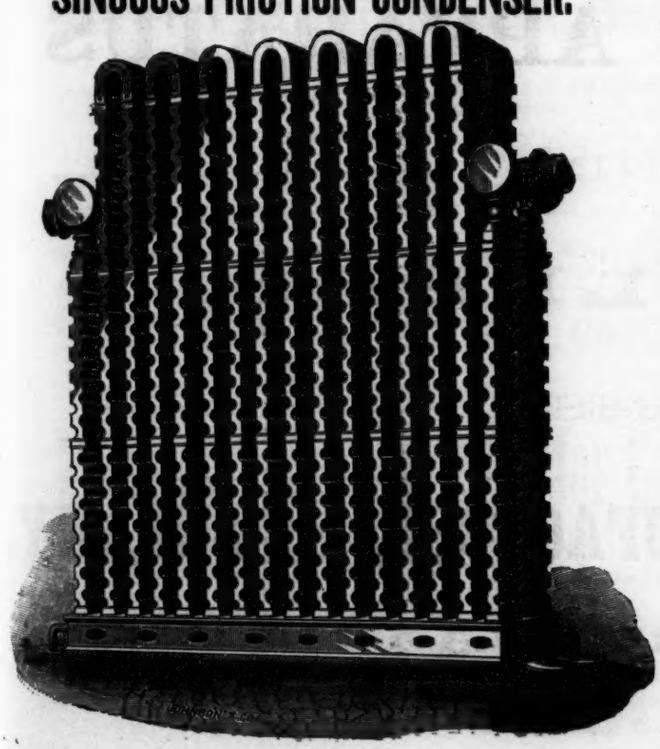

We desire to draw the attention of the gas community to the merits of the SINUOUS FRICTION CONDENSER. Companies intending to introduce new condensers into their works will do well to confer with us and examine plans and estimates before contracting for any other pattern The FRICTION CONDENSER is now in use at the gas works located in the following places:

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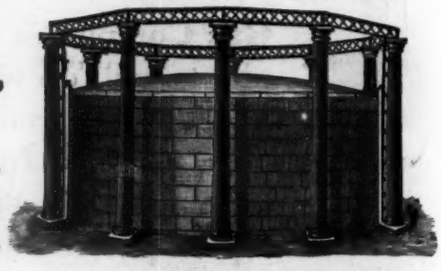

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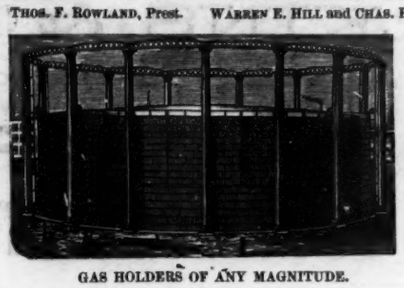

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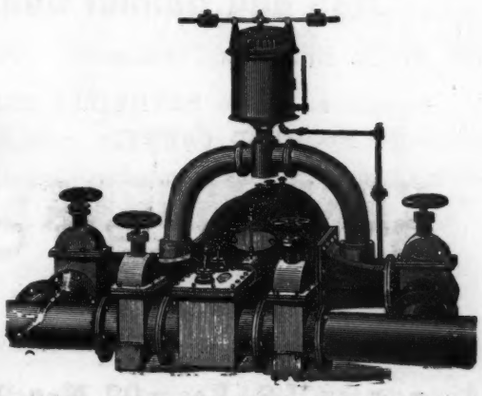

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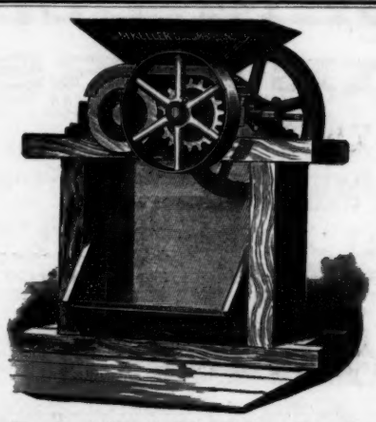

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SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
37 in. high.	12 in. high.	12 in. high.	24 in. long.	36 in.
20 in. wide.	17½ in. wide.	18 in. wide.	21 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has four burners on top, and double oven burner.

Consumption of gas with all burners in use, 42 feet per hour, at 1 inch pressure.

The top is made in sections, so that a greater variety of cooking utensils may be used. By lifting out the covers and crosspieces and putting in a suitable forked ring, which is sent with each stove, a wash boiler or other large utensil may be set over two burners. Our **No. 87 GRIDDLE** also fits in the same position. The roasting oven is provided with a cast-iron door.

All Fittings are Nickel-Plated.

GAS COOKING STOVE, No. 7 B.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
31 in. high.	9½ in. high.	10 in. high.	21 in. long.	32 in.
17 in. wide.	14½ in. wide.	15 in. wide.	16 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has three boiling burners in the Top or Hot Plate, and one single oven burner.

This cut represents our New Style Cooking Stove. As will be seen, it has an ornamented cast-iron Base and Front, and extension shelves. The Oven Burner, which is atmospheric (unless otherwise ordered), is of an entirely new and improved pattern (patent). The ovens are of greater capacity than those of the old style. The Top, in conjunction with the Outlet Pipe, is designed to carry off all the products of combustion, if desired, but they are also supplied with a loose ring which converts it into an ordinary open top stove.

The consumption of this Stove is 35 cubic feet per hour at 1 inch pressure, with all Burners in use.

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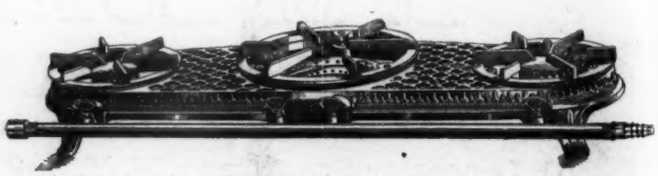
Size, 6⅛ inches diameter, 8 inches high. Consumption, 6 feet per hour at 1 in. pressure.



HOT PLATE, No. 111.

Size, 26 in. long, 12 in. wide, with three double burners, 6 taps.

Consumption, with all burners in use, 36 cubic feet per hour, with 1 in. pressure.

½ in. supply pipe should be used where the pressure is 1 in. or over.